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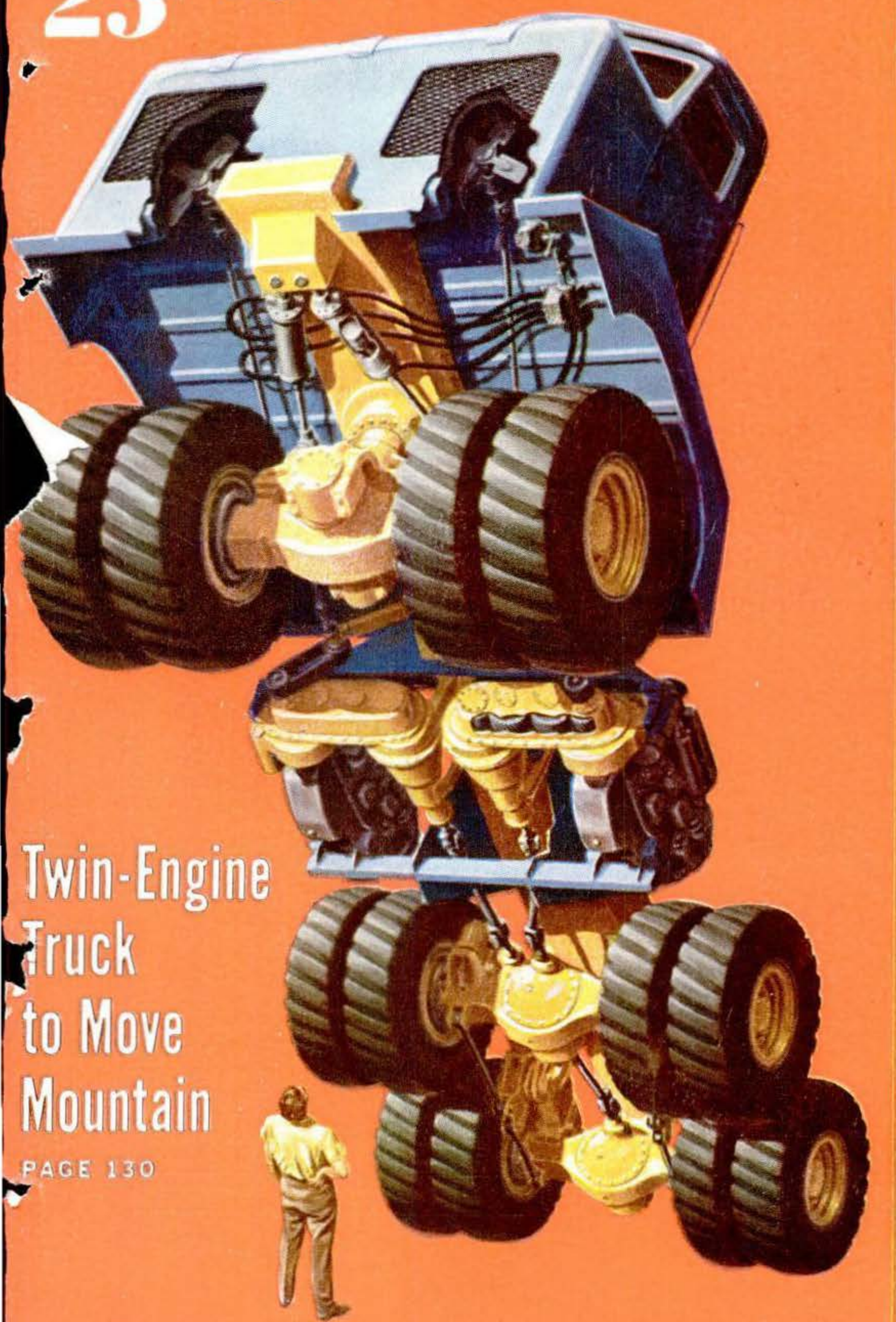
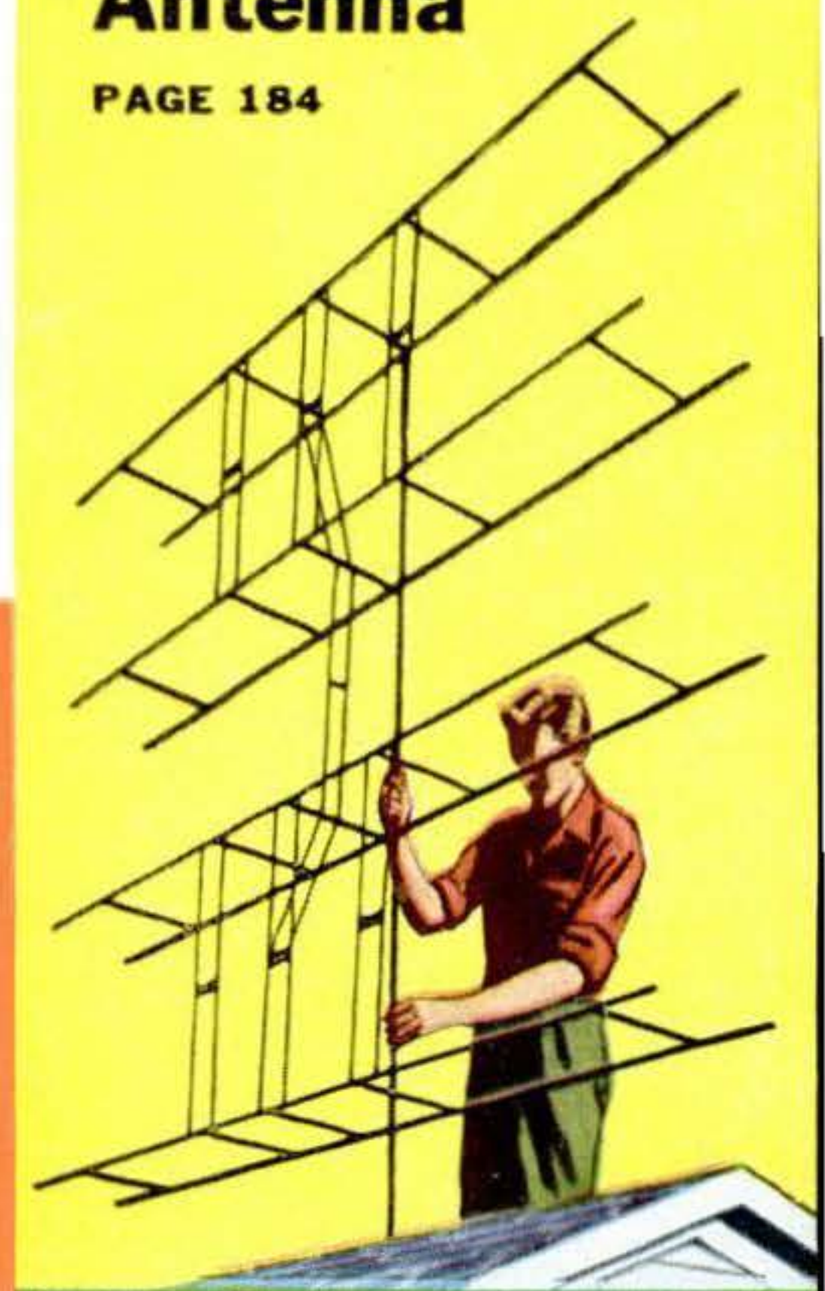


Twin-Engine Truck to Move Mountain

PAGE 130

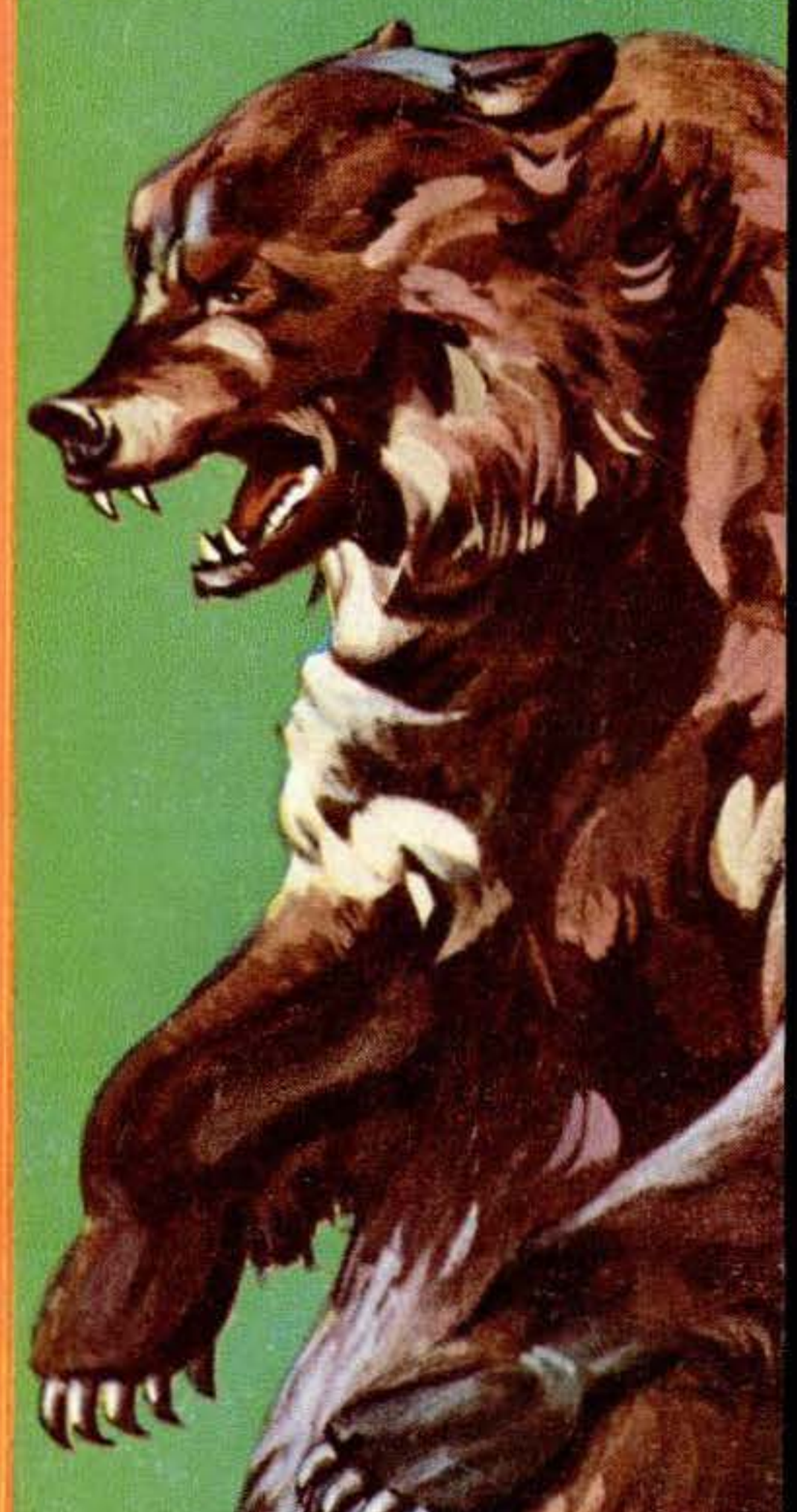
Choosing Your Antenna

PAGE 184



How Cave Men Conquered the Giant Bears

PAGE 112



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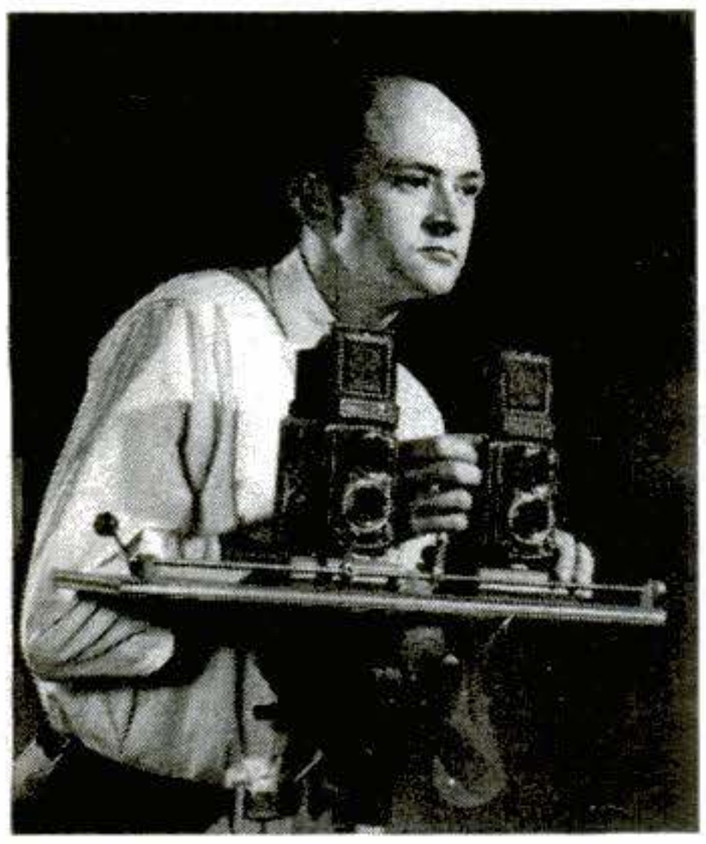
AUGUST, 1953

How We Took 3-D Photos



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He Recaptures Aviation's Good Old Days.... 65
Hero's Medal Honors Miner Who Saved Pal.. 70
The Toughest Peaks Are Still Untouched.... 80
A New Magic Bullet Cures an Old Disease.... 87
New Airliner Gears Jets to Props..... 92
"Squeezed" Movies Challenge 3-Ds.....100
Trick Engine Head Ups Gas Mileage 50%....106
Explorers Tell of Monster Cave Bear.....112
"Golden Boy" of Motorcycle Racing.....120
Wilbur Shaw Reports on the Biggest Truck..130
Can You Beat the Heat?.....149
Gus Peps Up a Tired Truck.....158
About Overhead Garage Doors.....163
How to Get Hot Sparks Oftener.....170
Retaining Walls.....174
Choosing the Right TV Antenna.....184
You Run This Tractor by Radio.....188
Pictures Made with Mirrors.....204

(More features and departments are listed on page 4.)

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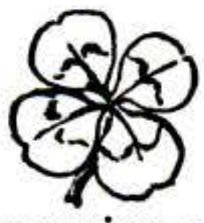

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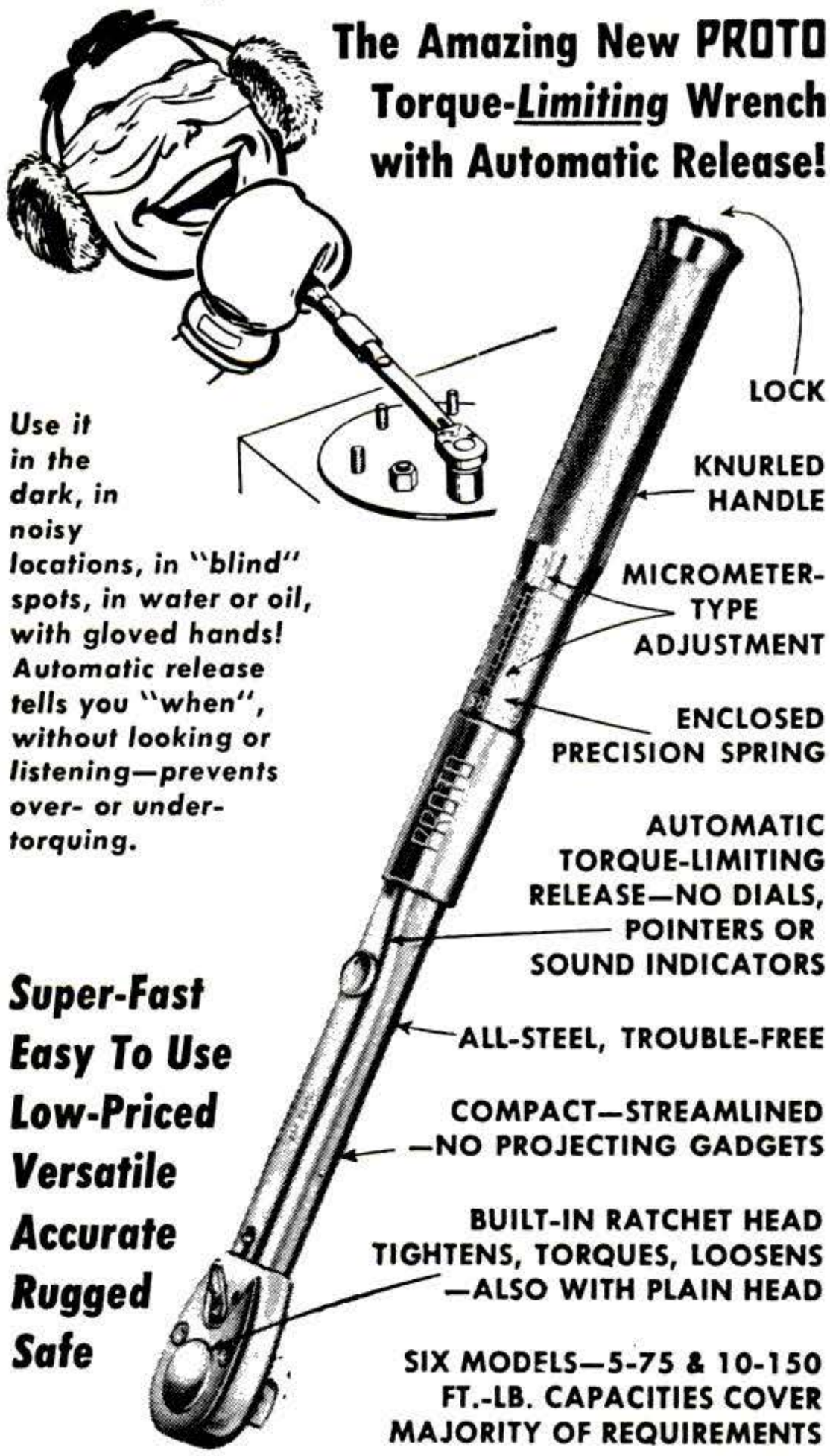

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News and Pictures

Big-Scale Designs for A-Power..... 73
Ocean Diver Rides Pedal-Powered Sub.. 76
Superhighway Bridge Will Almost Float 84
Depth Charges Spot Undersea Oil..... 90
There's a Surprise Under This Hood..... 97
Here's a Tricycle Built for Seven.....111
What Camera Are You Facing?.....126
Your Car's Electric System.....138

Mechanics and Homebuilding

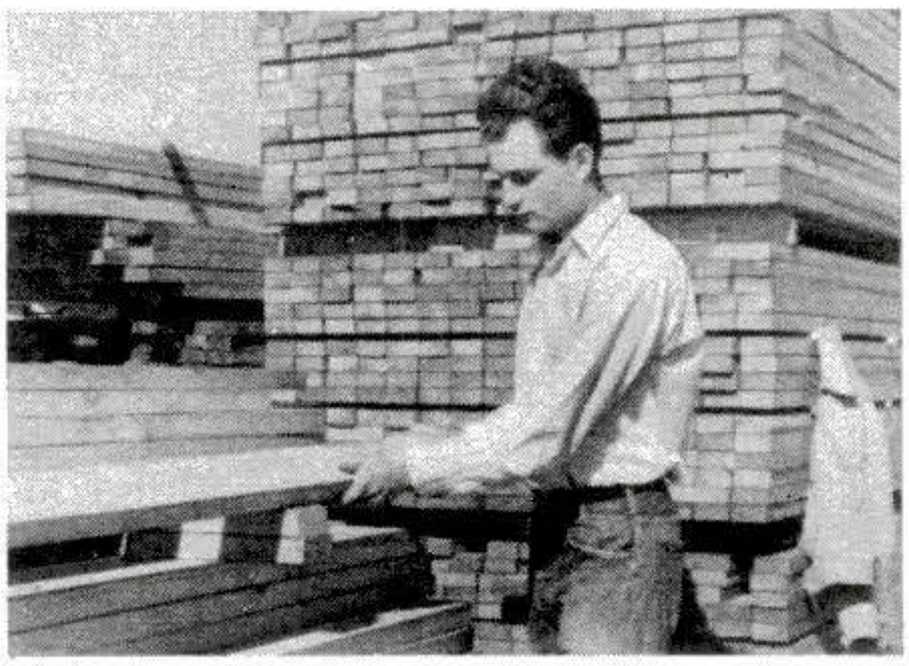
How I Built My Food Freezer.....152
New for Your Car.....156
Shopsmith Gets New Accessories.....182
Chairside Cabinet Now Hides My Radio..186
Gardening with Gasoline.....194
Wordless Workshop.....196
You Can Use Plastic Covers.....198
Simple Steps Defy Rot.....199
Iron and Plywood Build Modern Desk....200
Lathe Compound Is Drilling Fixture.....208

Departments

Letters 8
I'd Like to See Them Make..... 99
New Ideas from the Inventors.....135
P.S. Last Minute News and Notes.....140
Keeping the Home Shipshape.....153
New for the Handy Man.....155
Hints from the Model Garage.....161
New Tools.....193
New Shop Ideas.....202

NEXT MONTH . . .

All About Buying Wood



Lumber is what costs you most in any home carpentry or cabinetmaking job. With wood prices up, good shopping can make a difference of many dollars. A special 16-page feature in the September issue will give the low-down on house lumber, plywood, craft woods and moldings. You'll want to save it.

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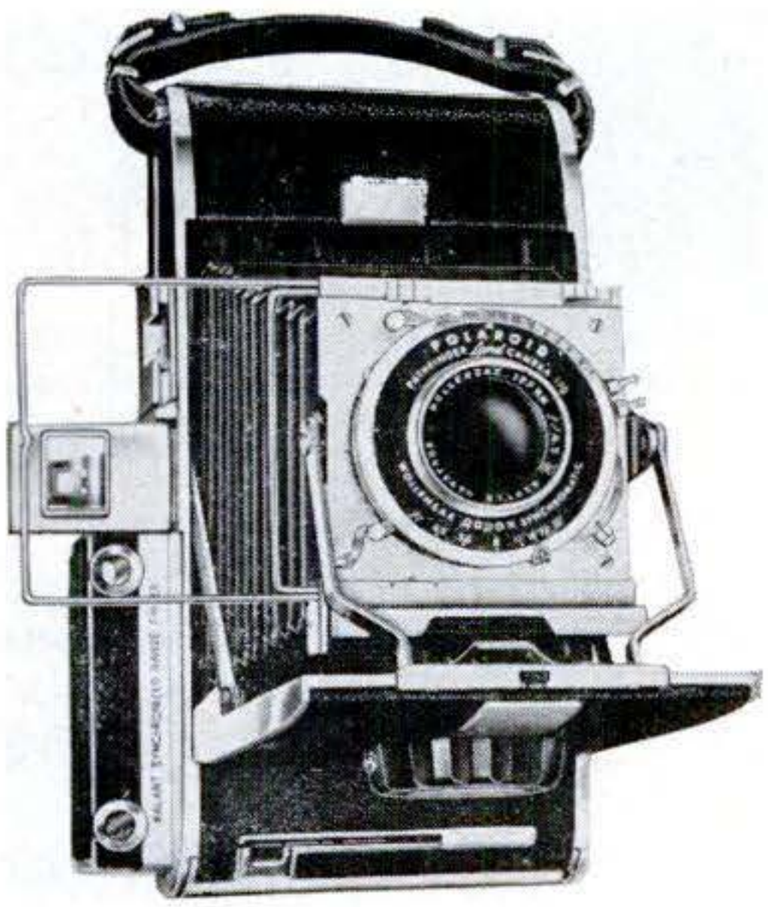

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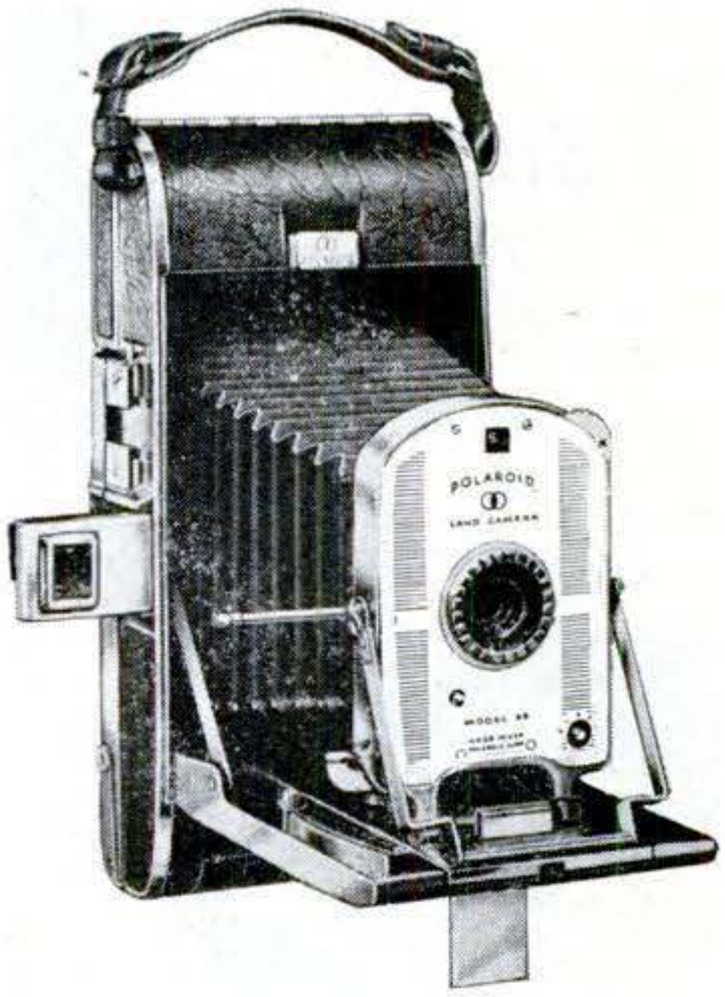

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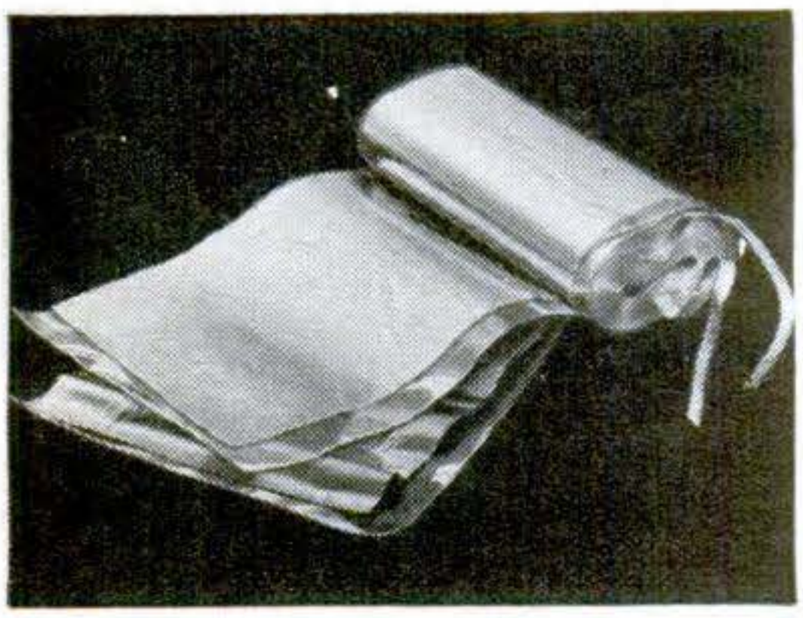

Unrolled view (reduced size) of capacitor unit wound with "Mylar." The transparent film is only 0.0005" thick yet stands handling without breaking.

Among the elements that guard your dial telephone service are electrical capacitors. They help prevent the formation of arcs that pit and may eventually destroy relay contacts. But millions more of these capacitors are needed each year. How could they be made less costly?

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The film takes the place of impregnated paper once used to separate the metal foil electrodes. It is tougher, stands more voltage, needs no impregnation. The new capacitors require no protective housing and are *much* smaller and less costly.

Here is another example of the way America's technology advances through the sharing of knowledge. Just as Bell Telephone Laboratories makes many of its discoveries—the Transistor, for example—available to other companies, so does it adapt the inventiveness of others when it can help your telephone service.

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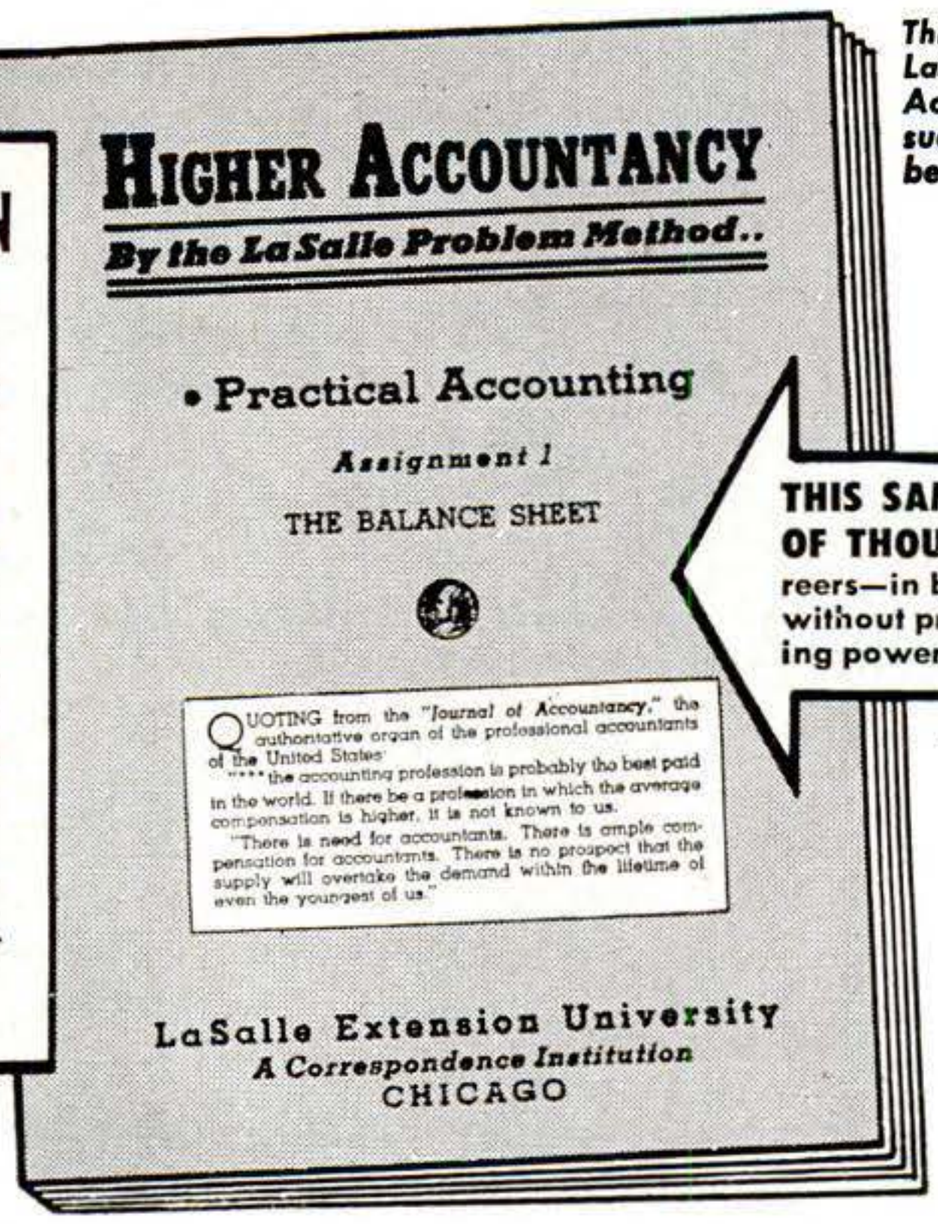

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Then let us send you—without cost or obligation—the same Lesson Number One with which LaSalle has started several hundred thousand men and women toward successful accounting careers. We want you to see for yourself how this remarkable method, originated by LaSalle, makes Accountancy simple, interesting, practical, and certain . . . how it leads you step-by-step to a complete mastery of Accounting—and on up to the coveted degree of Certified Public Accountant if you so aspire.

It doesn't matter whether you've had previous bookkeeping experience, or whether you don't know a debit from a credit. Whether you wish to qualify as an expert bookkeeper, advanced accountant, cost accountant, auditor, government accountant, income tax specialist, or public accountant . . . you'll find in LaSalle's Problem Method the exact plan to prepare you rapidly and inexpensively—in spare hours at home—without losing a day from your present job.

So right now, today . . . if you are an adult, employed, and earnestly ambitious for rapid advancement in this highest-paying of all professions . . . send your name and address on the coupon below. We'll send the free sample lesson—plus our 48-page book outlining today's career opportunities and how you can qualify for them. A coupon like this has started many thousands toward greater success. It can do the same for you. Mail it today!

GOOD-PAY JOBS IN 5 BIG FIELDS

If you were an expert accountant right now, chances are you would find yourself among the highest-paid of all professional men and women. Surveys show that accountants earn more than those in other major professions.

There are five big fields of opportunity open to Accountancy-trained men and women . . . opportunities that are wide open and highly inviting, offering maximum income and job security in good times or bad. And under LaSalle's "Problem Method" you can start earning while still learning—either in spare-time or full-time employment . . . or in business for yourself with no capital required.

Get the latest information by sending for our 48-page book, "Accountancy, the Profession That Pays" . . . plus free sample lesson. The coupon at right will bring both to you without cost or obligation. LaSalle Extension, 417 S. Dearborn St., Chicago 5, Ill.

Clip Coupon . . . Mail TODAY!

LaSalle Extension University . . . *A Correspondence Institution*
Dept. 883-H, 417 S. Dearborn Street, Chicago 5, Illinois

YES, I want to see how LaSalle's "Problem Method" works.. how I can qualify for high-pay Accountancy positions. Send Free Sample Lesson — also your 48-page book, "Accountancy, the Profession That Pays" ...all without cost or obligation.

Name. . . . . *Age*. . . . . .

Street Address. . . . . .

City, Zone & State. . . . . .

Present Position. . . . . .

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Quietest Tread on Earth...
Outgrips, Outwears them all!

ARMSTRONG
Rhino Flex
PREMIUM
THE MIRACLE-RIDE TIRE

● **FOUR EXCLUSIVES** give you safety, silence, comfort found in no other tire. **(1) Interlocking Safety Tread** for greater "hold" in *all* directions. **(2) Silent Traction Design** cancels out hum and sing for world's quietest ride. **(3) Intra-Tread Bumpers** hold tread ribs apart . . . muffle squeal. **(4) Uni-Cushion Contour**—more rubber on road for smoother riding, longer wear.

Makers of Armstrong Pure Foam Cushioning

Unconditionally Guaranteed 3 Years!

Unserviceable tire will be replaced by comparable new tire with full credit for the period of guarantee not realized.

ARMSTRONG RUBBER COMPANY, West Haven 16, Conn.; Norwalk, Conn.; Natchez, Miss.; Des Moines, Iowa; 601 Second Street, San Francisco, Calif. Export Division: 20 East 50th Street, New York 22, N.Y.

Letters

Relativity on the Highway

Your articles on autos give data on piston travel in feet per car mile at 20 m.p.h. Isn't the piston travel per car mile the same, regardless of car speed?

COURTLANDT W. BABCOCK, Brookline, Mass.

The reason for specifying piston travel at a particular speed is the expansion of tires caused by centrifugal force. If the diameter of a tire increases as little as ⅛ inch at, say, 70 miles an hour, a 24-inch wheel will make eight fewer revolutions a mile than it would make at 20 miles an hour. The fewer wheel revolutions, of course, the fewer engine revolutions.

Helicopter Fire Engine

The recent collision of two tankers in the Delaware River, and the resultant fire, brings to mind a suggestion.

In this case, as in many ship fires, the fire fighters were dependent either on equipment on board the burning ships themselves or on the appearance of a fireboat.

Why not have a method of fire fighting from the air?

My suggestion is for a specially equipped helicopter or an auxiliary piece of fire-fighting equipment that any helicopter could carry in an emergency. It would include a tank of CO_2 or some approved fire-fighting chemical that could be sprayed from a fog nozzle from above to blanket the fire. This would at least help to keep the fire in check

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How To Stumble Upon A Fortune in GEMS

All over the U. S. — Diamonds, Pearls, Amethysts, Opals, Garnets, Jade, Rubies, Topaz, Sapphires, Turquoise, Zircons, and other Precious and Semi-Precious Stones are Waiting to be Picked Up!...

Here is Exactly HOW and WHERE to Find Them...

Next time you trip on a rock—examine it carefully. You may have "walked into" a real fortune — unexpectedly. Last year alone, over half a MILLION dollars worth of stones were found by week-end gem hunters. A youth pitching horseshoes in an open lot picked up a stone and kept it in his pocket for 15 years before he discovered it was the largest alluvial diamond ever found in the U. S. A. ... 34.46 carats in weight. Two salesmen went gem-hunting on vacation and found a small pocket of "Tourmaline," a semi-precious, crystal gemstone, worth $13,500.

IF YOU FOUND THIS IN YOUR BACKYARD

(as Wm. P. Jones of West Va. did) Would YOU know it was a 34.46 Carat Diamond? (see story at left)

Are You "Passing Up" *Real* GEMS Near Your Home?

Valuable gems are all around us—half hidden by surface dirt and other rock. Perhaps in an abandoned quarry near your home, a river bottom, a rocky hillside, a beach, or an old cave. If you know WHERE to look and how to RECOGNIZE the more precious stones—you can enjoy an educational hobby that can pay off BIG.

Now you can enjoy and profit by gem-hunting—no matter where you live in the U.S.! Brand-new book, "Gem Hunter's Guide" tells all you need to know. Exactly where to find scores of precious and semi-precious gems. Where to find rich PEARL-bearing mussels. Complete town-by-town and gem-by-gem cross-index helps you plan week-end and one-day gem hunts. How to recognize each variety... clear photos of gems in their natural state make it easy. Simple tests you can give the rocks you find, plus 1,350 locations where gem materials have been found all over U.S.A. and a special chapter on how to identify quickly 69 different and valuable gemstone varieties. Book is handsomely bound, contains over 200 pages packed with illustrations, photos, maps, etc.

SEND NO MONEY

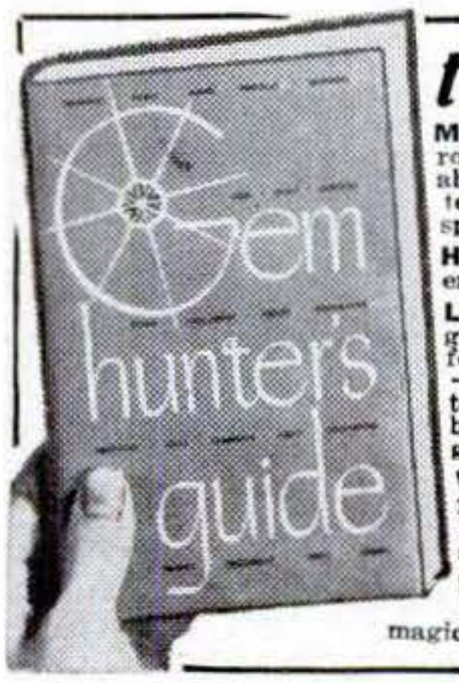
Examine FREE For 5 Days

SEND NO MONEY. Just fill out and mail the coupon below. We will send the "Gem Hunter's Guide" for you to examine *Free* for 5 days entirely at our own risk and expense. If you decide to buy the book, it may be the richest investment you ever made. In a single day, it may pay you back many thousands of times its small cost. So rush coupon NOW for 5 days' FREE examination in your own home.

Science & Mechanics Magazine
450 East Ohio Street, Chicago 11, Illinois

Do you know that

- Big, valuable, perfect Pearls have been found in many sections of the U. S.?
- 48,000 Diamonds have been found in Arkansas alone?
- A Diamond weighing over 20 carats was found in Va.?
- A vast region surrounding the Great Lakes holds the greatest store of Diamonds yet to be found in the U.S.?
- Gem sapphires are found in Colorado, Idaho, Montana, New Jersey, New Mexico, and North Carolina?
- For every diamond already found in this country, there are thousands more yet to be found?
- A cowboy found an Opal worth $280,000.00?
- Mid-west streams have produced as much as *half a million* dollars worth of the Pearls in a single year?
- 10-pound Turquoise nugget, believed largest ever found, discovered recently in one of our western states?
- Valuable Gems are discovered in all parts of the U.S.—even in New York City area?



tells you:

MANY WAYS to test rocks to see how valuable they are: the color tests, hardness and specific gravity tests

HOW to plan a week-end gem-hunting trip

LOCATIONS where gem materials are found in EACH State — complete town-by-town index; also gem-by-gem cross-index giving town & county

WHERE rubies are found in Georgia, Idaho, New Jersey and No. Carolina

HOW to make drab rocks glisten like magic with "black light"

HOW TO IDENTIFY over 69 different gem materials by hardness, composition, color, luster, cleavage, associated rocks, etc.

METHODS for classifying gems by families

WHERE big diamonds, pearls and rubies have been found in the U. S.

A SIMPLE PLAN for finding and harvesting pearl-bearing mussels

THAT GEM QUALITY emeralds may be found in Maine, Massachusetts, New Mexico, Nevada, and North Carolina

...ALSO special illustrated portfolio of various gem materials in their natural state.

Science & Mechanics Magazine, Dept. 754
450 EAST OHIO STREET, CHICAGO 11, ILL.

Please send me—for 5 days' FREE EXAMINATION—a copy of the "Gem Hunter's Guide" packed with pictures, maps, charts, expert advice telling where gems may be found. Unless completely satisfied with the book at the end of 5 days' examination, I may return it and owe nothing. Otherwise, I will keep it and send you only $2.95, plus 25c to cover postage and handling charges.

*Name*_____

*Address*_____

*City, Zone & State*_____

☐ **SAVE 25c POSTAGE AND HANDLING CHARGES**...by enclosing only $2.95 WITH this coupon. Then WE will prepay ALL delivery charges. Return book within 5 days for full refund if not delighted.

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QUINSANA FIGHTS ATHLETES FOOT INFECTION

QUINSANA works full-time—and *fast!* 9 out of 10 report amazing results. 91% of foot specialists interviewed used it on their patients. For burning, itching feet—cracking, peeling skin . . . get QUINSANA quick!

Soothes, cools tired feet!

until additional equipment got to the scene.

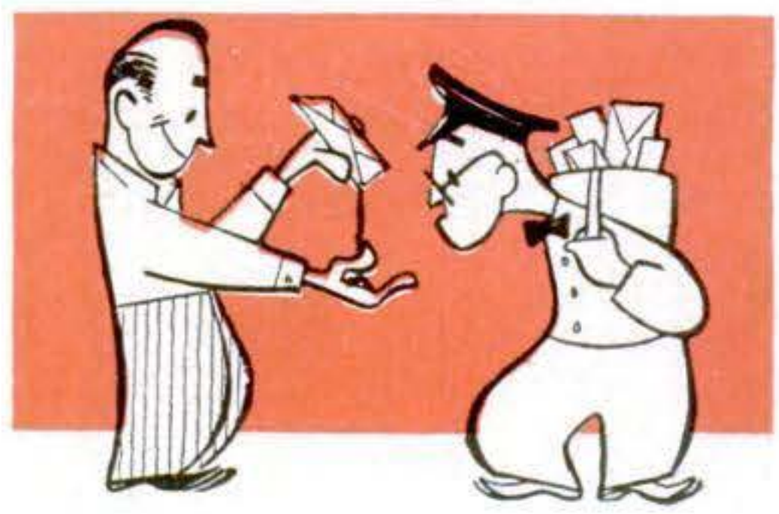
Use of a helicopter in this manner might also prove useful on certain types of land fires, small building fires, brush fires, etc.

ROBERT J. MILLS, Valley Stream, N.Y.

Wanted: Dirt from All Over

I have been assigned, as a school project, to make a large map of the United States and Alaska during the summer months. It would be of more than usual interest if it were possible to obtain a bit of soil from each state and Alaska to put on the map.

Since it would be too costly and impossible for me to travel enough in three months to cover the United States, I thought perhaps someone in each state and Alaska might like to do me a favor by sending a bit of their soil my way. It would take only



a teaspoonful, which could easily be sent in an envelope. A level teaspoon would require only 3¢ postage, even from Alaska.

PAUL D. EAVES, 746 First Ave., Gadsden, Ala.

Against Rear Engines

I'd like to get into the argument over rear-engine cars, on the negative side:

It is not true that the present-day car is nose-heavy—the weight is almost equally shared by the front and rear wheels. This is due to the fact that the engine and transmission are placed slightly to the rear of the front wheels. Also, the differential helps balance the weight distribution, the ideal condition being slightly more weight over the driving wheels.

However, in rear-engine construction the engine has to be behind or directly above the rear wheels to allow for a back seat. That means the weight of the engine, transmission and differential all are borne by the rear wheels, hence increased tendency to skid and maybe a need for dual wheels.

The popular European rear-engine cars are small and have light engines—some air-cooled to decrease the concentration of weight at the rear. They also have spare

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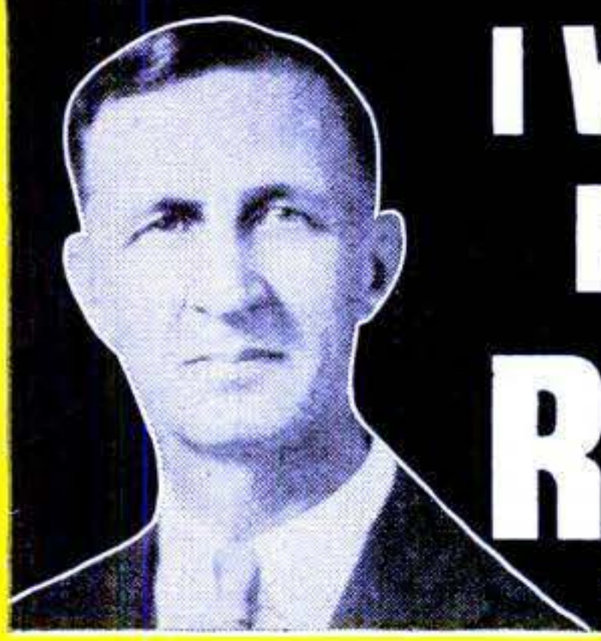

I WILL TRAIN YOU AT HOME FOR GOOD PAY JOBS IN RADIO-TELEVISION

J. E. SMITH has trained more men for Radio-Television than any other man.

2 FREE BOOKS SHOW HOW MAIL COUPON

America's Fast Growing Industry Offers You

I TRAINED THESE MEN

LOST JOB, NOW HAS OWN SHOP
"Got laid off my machine shop job which I believe was best thing ever happened as I opened a full time Radio Shop. Business is picking up every week."—E. T. Slate, Corsicana, Texas.

GOOD JOB WITH STATION
"I am Broadcast Engineer at WLPM. Another technician and I have opened a Radio-TV service shop in our spare time. Big TV sales here . . . more work than we can handle."—J. H Bangley, Suffolk, Va.

$10 TO $15 WEEK SPARE TIME
"Four months after enrolling for NRI course, was able to service Radios . . . averaged $10 to $15 a week spare time. Now have full time Radio and Television business."—William Weyde, Brooklyn, New York.

AVAILABLE TO **VETERANS** UNDER G.I. BILLS

WANT YOUR OWN BUSINESS?

Let me show you how you can be your own boss. Many NRI trained men start their own business with capital earned in spare time. Robert Dohmen, New Prague, Minn., whose store is shown at left, says, "Am now tied in with two Television outfits and do warranty work for dealers. Often fall back to NRI textbooks for information."

1. EXTRA MONEY IN SPARE TIME

Many students make $5, $10 a week and more EXTRA fixing neighbors' Radios in spare time while learning. The day you enroll I start sending you SPECIAL BOOKLETS that show you how. Tester you build with kits I send helps you make extra money servicing sets, gives practical experience on circuits common to Radio and Television. All equipment is yours to keep.

2. GOOD PAY JOB

NRI Courses lead to these and many other jobs: Radio and TV service, P.A., Auto Radio, Lab, Factory, and Electronic Controls Technicians, Radio and TV Broadcasting, Police, Ship and Airways Operators and Technicians. Opportunities are increasing. The United States has over 105 million Radios—over 2,900 Broadcasting Stations—more expansion is on the way.

3. BRIGHT FUTURE

Think of the opportunities in Television. Over 15,000,000 TV sets are now in use; 108 TV stations are operating and 1800 new TV stations have been authorized . . . many of them expected to be in operation in 1953. This means more jobs—good pay jobs with bright futures. More operators, installation service technicians will be needed. Now is the time to get ready for a successful future in TV! Find out what Radio and TV offer you.

You Learn Servicing or Communications by Practicing With Kits I Send

This Is Just Some of the Equipment My Students Build. All Parts Yours to Keep.

Television Is Today's Good Job Maker

TV now reaches from coast-to-coast. Qualify for a good job as a service technician or operator. My course includes many lessons on TV. You get practical experience . . . work on circuits common to both Radio and Television with my kits. Now is the time to get ready for success in Television!

Keep your job while training at home. Hundreds I've trained are successful RADIO-TELEVISION Technicians. Most had no previous experience; many no more than grammar school education. Learn Radio-Television principles from illustrated lessons. You also get PRACTICAL EXPERIENCE. Pictured at left are just a few of the pieces of equipment you build with kits of parts I send. You experiment with, learn circuits common to Radio and Television.

Mail Coupon—find out what RADIO-TELEVISION Can Do for You

Act Now! Send for my FREE DOUBLE OFFER. Coupon entitles you to actual Servicing Lesson; shows how you learn at home. You'll also receive my 64-page book, "How to Be a Success in Radio-Television." Send coupon in envelope or paste on postal. J. E. SMITH, Pres., Dept. 3HB National Radio Institute, Washington 9, D. C. Our 39th Year.

Good for Both—FREE

MR. J. E. SMITH, President, Dept. 3HB
National Radio Institute, Washington 9, D. C.
Mail me Sample Lesson and 64-page Book, FREE (No salesman will call. Please write plainly.)

Name ..... Age .....
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City ..... Zone ..... State .....

VETS write in date of discharge .....

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How HATLESS MEN keep hair neat all day long!

● New-formula grooming aid gives hair *naturally*-neater look without gooey grease or cream!

● Removes flaky dandruff . . . makes scalp feel better, more refreshed!

Whether you go hatless or not, keep hair neatly groomed *all* day the way so many outdoor men do—with Fitch Ideal!

See the neatest trick of all—as Ideal's secret grooming agent . . . *not* a grease, oil nor cream . . . makes thin hair look thicker —thick hair *stay* slicker!

Ideal *also* relieves dry, itchy scalp—*also* removes loose dandruff—*while* it works its grooming miracles!

Feel its new tonic action. Feel your scalp tingle with invigorating freshness! Note—there's *no* lingering, tell-tale odor!

Start tomorrow. Just seconds—massaging hair and scalp with a dash of new Fitch Ideal—will pay off *all* day! You can count on Fitch Ideal for that smart, *naturally*-neater look of the man who's going places! At all drug counters — also ask Barbers for professional applications.

Get new

FITCH *Ideal* HAIR TONIC

wheels, gas tank and sometimes the battery moved to the front to help distribute the weight more evenly. This leaves little or no convenient space for luggage. Until light-alloy engines are produced equaling today's standards, the rear-engine family car is only a dream.

STAN THACKER, Victoria, B.C., Canada.

Midnight Ride

After enjoying the science-fiction story in the June issue, "Islands in the Sky," I turned to the announcement of the Model T Contest. That night I had a peculiar dream:

I dreamt I climbed into my Model T
And took off for a trip to the Moon;
I visited Venus and Mercury,
Jupiter, Mars and Neptune.

At a breath-taking pace I toured outer space,
Skimmed the Milky Way flying quite blind;
I challenged a rocket to a one-sided race,
And left it 10 light-years behind.

The music of the spheres was sweet to my ears,
Combined with the Tin Lizzy's din,
Till my gas ran low, then a tire had to blow,
And I realized the spot I was in.

If she started to stall—what a terrible fall!
I nearly got nervous prostration;
But it turned out okay: Just a million miles away
Was the Mercury service station.

As I chugged through the night, spacemen cheered my strange flight,
With no hint of scorn or derision:
For my journey afar, I had picked the right car—
With a *planetary* transmission!

SYLVESTER MCLEOD, Forest Hills, N.Y.

Better Read This Slowly

One of your recent issues infers that Rolls-Royce has the only transmission allowing a one-gear upshift, a two-gear upshift and a three-gear upshift. Although the Dual Range Hydramatic infers two options, there are actually three options. In the low range the transmission shifts once, in the second range it shifts twice, and in the third range it

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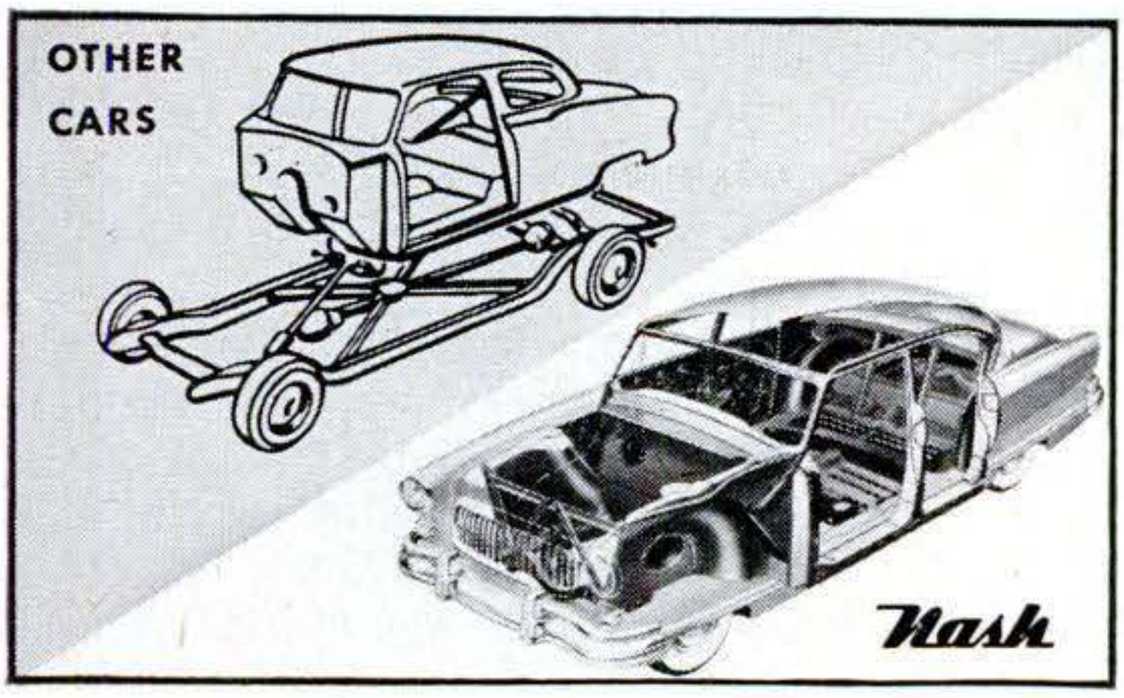
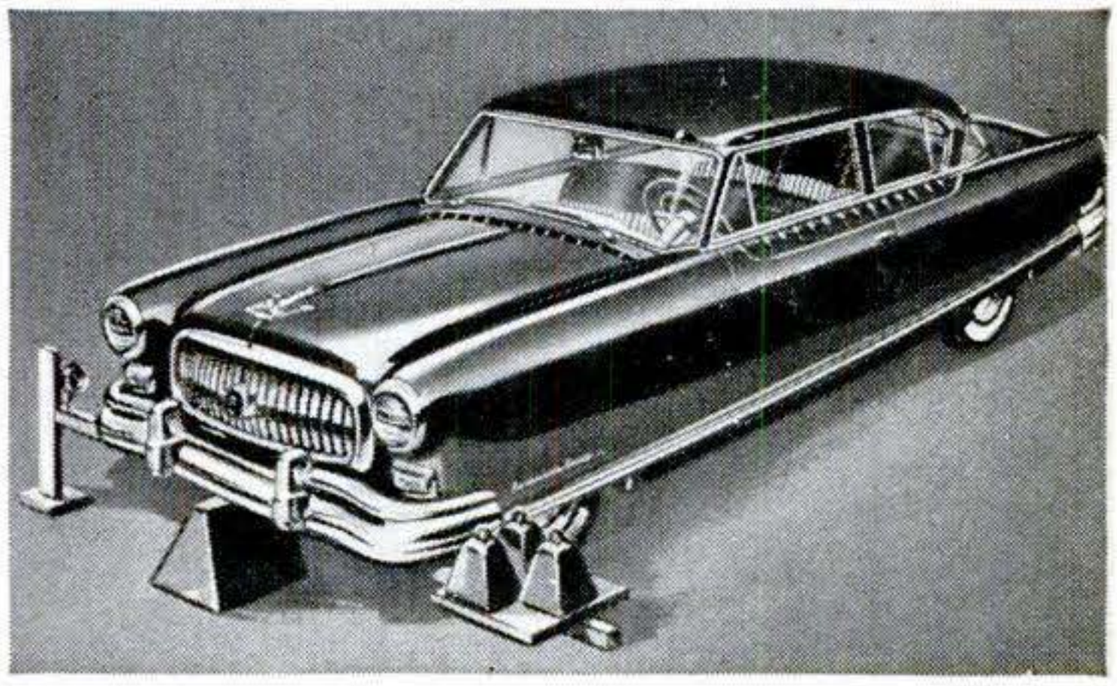
Do You Know?

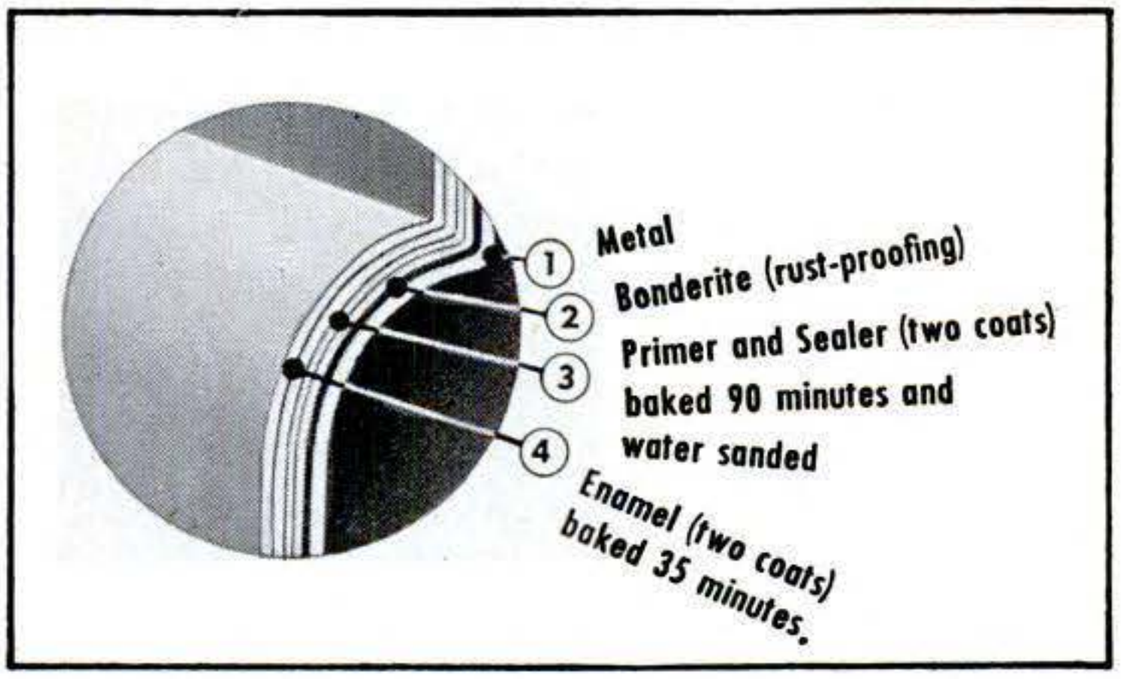
Why Nash Automobiles Stay New Years Longer?



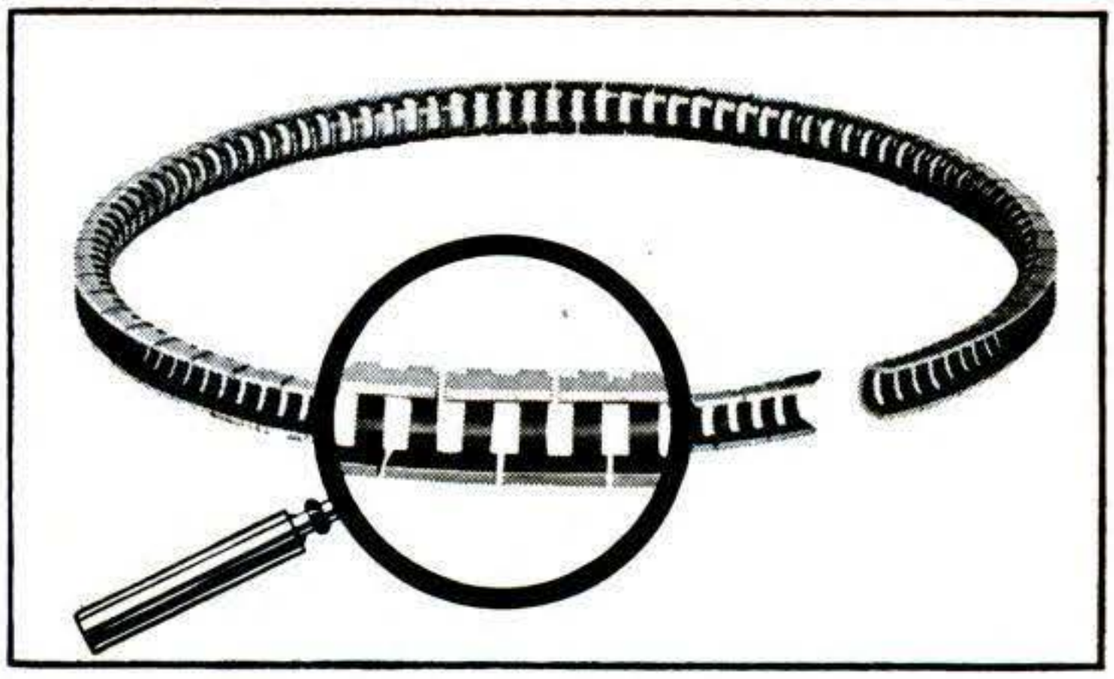
Ordinary cars have *separate* frame and body *bolted* together, which tend to loosen from road shocks and vibration, causing squeaks and rattles. In Nash Airflyte Construction, body and frame are welded into one unit that stays tight as new years longer.



Scientific tests show Nash Airflyte Construction has twice the torsional strength (resistance to twisting) of ordinary design—with greater life-saving strength surrounding the passenger compartment—strength that adds many miles to the life of a Nash.



To preserve the beauty of the baked enamel finish, all Nash cars are treated with Bonderite. This process provides an anchor for the finish, retards rust, cracking, chipping or peeling of the hard enamel—insures lasting beauty.



The "U-Flex" oil control ring, shown above, is typical of the many advanced engineering features found in all Nash engines. The slotted design meters a controlled quantity of oil and maintains uniform pressure. Uses less oil, increases engine life.

Nash cars are *designed* and *built* to remain new years longer. See and drive the new 1953 Nash Airflytes, Ambassador, Statesman, Rambler, styled by Pinin Farina, at your Nash dealer's. You'll find there are—

None So New As Nash Airflytes

Nash Motors, Div. Nash-Kelvinator Corp., Detroit, Mich.

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Neighbors Praise His Articles

"As a 'buy-product' of my N.I.A. Training, I have received a total of $73.00 for articles and material from Autobody and the Reconditioned Car. The local weekly, City and Suburban Life, printed one article and asked for more. When neighbors stop you on the street to say they read your piece, there's nothing like it."—George R. Maire, 114 9th St., Laurel Gardens, Pennsylvania.

Why Can't You Write?

It's much simpler than you think!

SO MANY people with the "germ" of writing in them simply can't get started. They suffer from inertia. Or they set up imaginary barriers to taking the first step. Many are convinced the field is confined to persons gifted with a genius for writing.

Few realize that the great bulk of commercial writing is done by so-called "unknowns." Not only do these thousands of men and women produce most of the fiction published, but countless articles on science, current events, business, sports, hobbies, travel, local, church and club activities, etc., as well.

Such material is in constant demand. Every week thousands of checks for $25, $50 and $100 go out to writers whose latent ability was perhaps no greater than yours.

The Practical Method

Newspaper work demonstrates that the way to learn to write is by writing! Newspaper copy desk editors waste no time on theories or ancient classics. The story is the thing. Every copy "cub" goes through the course of practical criticism—a training that turns out more successful authors than any other experience.

That is why Newspaper Institute of America bases its writing instruction on the Copy Desk Method. It starts and keeps you writing in your own home, on your own time. And upon the very same kind of *actual assignments given* daily to metropolitan reporters. Thus you learn by doing not by studying the individual styles of model authors.

Each week your work is analyzed constructively by practical writers. Gradually they help to clarify your own distinctive style. Writing soon becomes easy, absorbing. Profitable, too, as you gain the "professional" touch that gets your material accepted by editors. Above all, you can see constant progress week by week as your faults are corrected and your writing ability grows.

Have You Natural Ability?

Our FREE Writing Aptitude Test will reveal whether or not you have natural talent for writing. It will analyze your powers of observation, your imagination and dramatic instinct. You'll enjoy taking this test. There is no cost or obligation. Simply mail the coupon below, today. Newspaper Institute of America, One Park Avenue, New York 16, N. Y. (Founded 1925.) (Licensed by State of N. Y.)

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Send me without cost or obligation your *Writing Aptitude* Test and further information about writing for profit, as promised in Popular Science.

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shifts through all four gears. Low range keeps the transmission in second, the so-called "dual range" allows keeping the transmission in third, and the high range permits a shift to fourth range.

ELDEN D. JONES, Riverside, Calif.

Concrete Pitfalls

I found your May article on the $300 swimming pool quite interesting but I believe, as an engineer, that a few words of caution should be given to anyone attempting a similar feat. There are many pitfalls in concrete construction and it would be too bad to see $300 and 118 man-hours fall into one of these.

Concrete which is just a guesswork mixture of cement, aggregate and a random amount of water will not stand the ravages of time and climate. An immense amount of research has been done to discover how to make durable, leakproof concrete. Information is obtainable free of charge from the Portland Cement Association, whose sole interest is to prevent botched-up jobs giving concrete a bad name.

WILLIAM F. SAUNDERS, St. Louis, Mo.

Disposable Sun Lenses

I would like you to inform H. Gage of S. Chatham, Mass., that the "disposable sun lens," which he suggested in your "I'd Like To See Them Make" department in June, can be purchased in the form of automobile-windshield glare shields.

I purchased a pair of these green plastic glare shields for 29¢. When cut out to fit my glasses, they made 24 pairs of removable plastic lenses that may be stuck on by first blowing my breath on the glasses. They are easily removed and may be used many times. Cheap too.

KEN LANDIS, Neffsville, Pa.

Market for a Model A

Your series of articles on the Model T Ford, leading to your current contest, is fine. My own interest, however, lies with a later-model Ford: the Model A, years 1930-'31. I would like to get hold of a touring car of that vintage in rebuildable condition.

I have pretty well covered Connecticut in my search for such a car, with no success. I would appreciate hearing from anyone in this section of the country who might be able to guide me to one.

ROGER W. KNIGHT, R.F.D. 2,
West Simsbury, Conn.

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INVENTORS

Learn how to protect your invention. The U. S. Patent Laws provide that any new and useful art, machine, article of manufacture, or composition of matter, or any new and useful improvement thereof, may be patented if the act of invention is involved. Therefore, every inventor with a valuable invention should take advantage of the Patent Laws and proceed for patent protection in order to safeguard his rights.

A patent gives the inventor the exclusive right to prevent others from making, using, or selling the invention claimed in the patent for a period of seventeen years.

The Patent Laws were enacted for the benefit of the inventor to give him protection for the features of his invention which are patentable. These features must be properly and concisely set forth and claimed in a formal application for patent, in order to comply with the requirements of the Patent Laws. For that reason, unless the inventor is familiar with patent matters, he should engage a competent registered patent attorney or agent to represent him. We are registered to practice before the U. S. Patent Office and are prepared to serve you in the handling of your patent matters.

A specially prepared booklet entitled "Patent Guide for the Inventor", containing detailed information with respect to patent protection and procedure, together with a "Record of Invention" form will be promptly forwarded to you without obligation upon request.

CLARENCE A. O'BRIEN & HARVEY JACOBSON

Registered Patent Attorneys

32-H DISTRICT NATIONAL BUILDING

WASHINGTON 5, D. C.

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BECOME A
Mechanical Engineer

B. S. Degree in 36 months

50% of the nation's industrial leaders started their careers with engineering training. Today, young men like you are being urged to prepare for careers in these rapidly expanding fields. Nine separate programs give you a wide range of career opportunities.

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TECHNICIAN 12 to 18 months

- Radio and Television
- Electronics
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General preparatory course — 3 months

SERVICE 6 to 12 months

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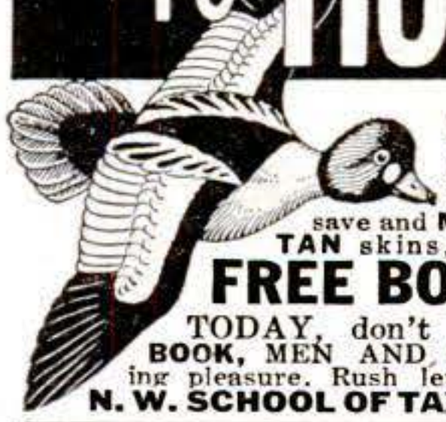

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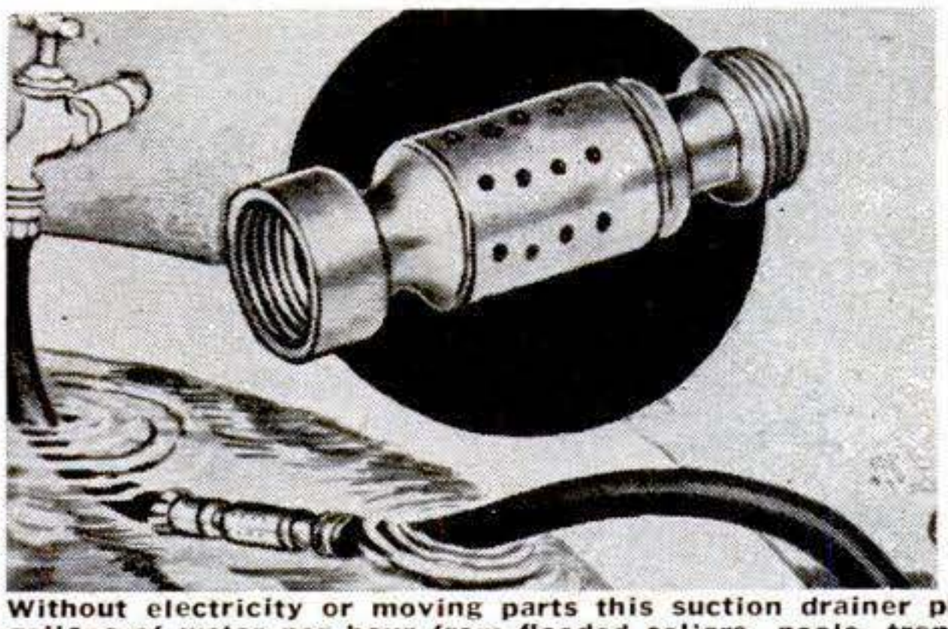

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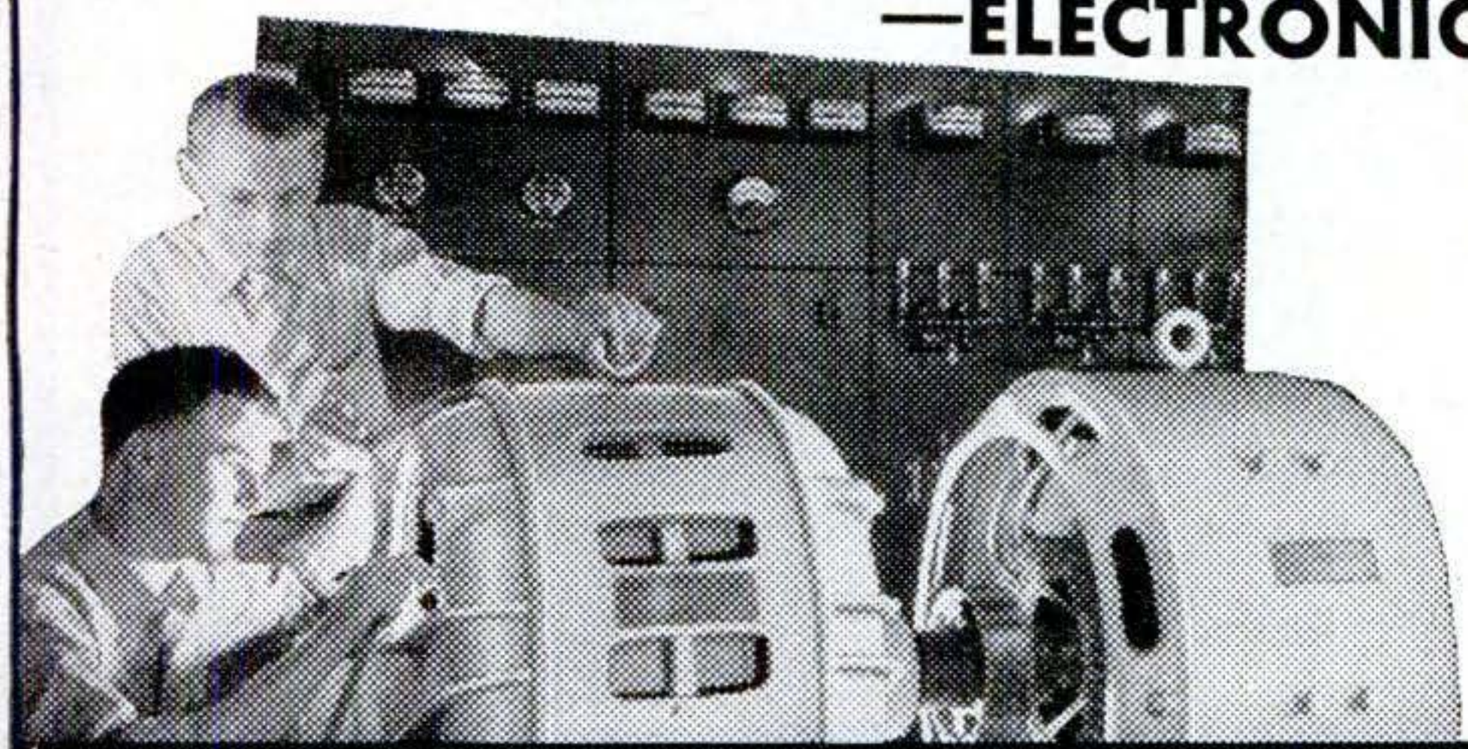

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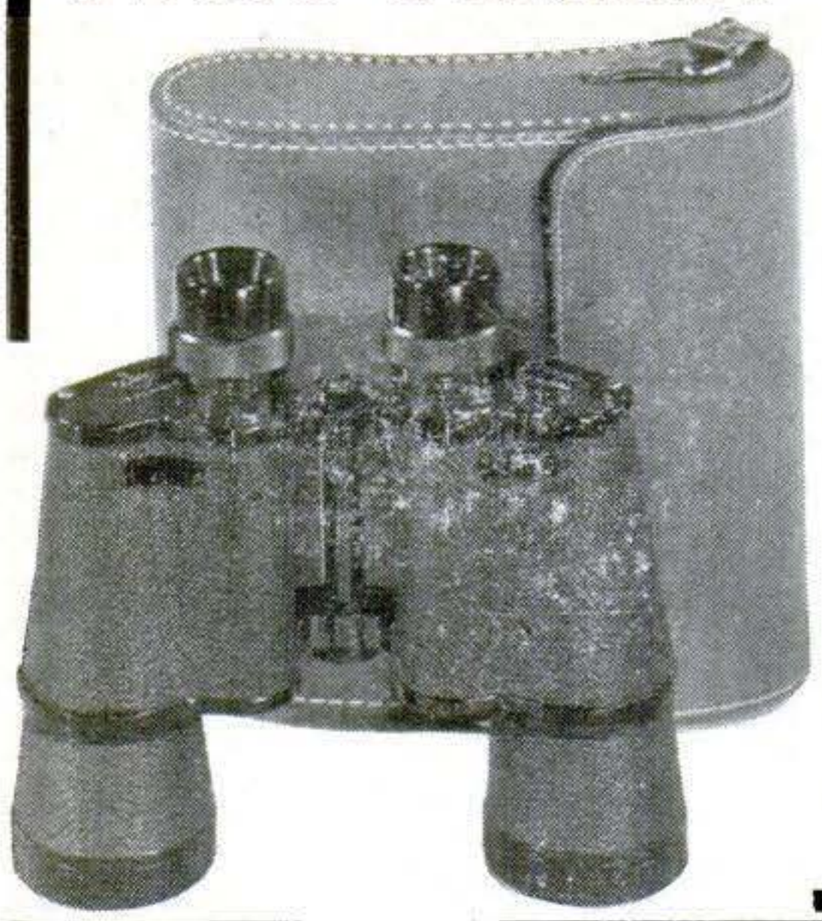

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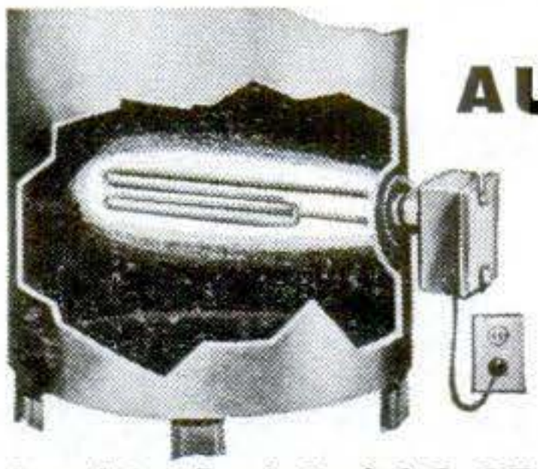

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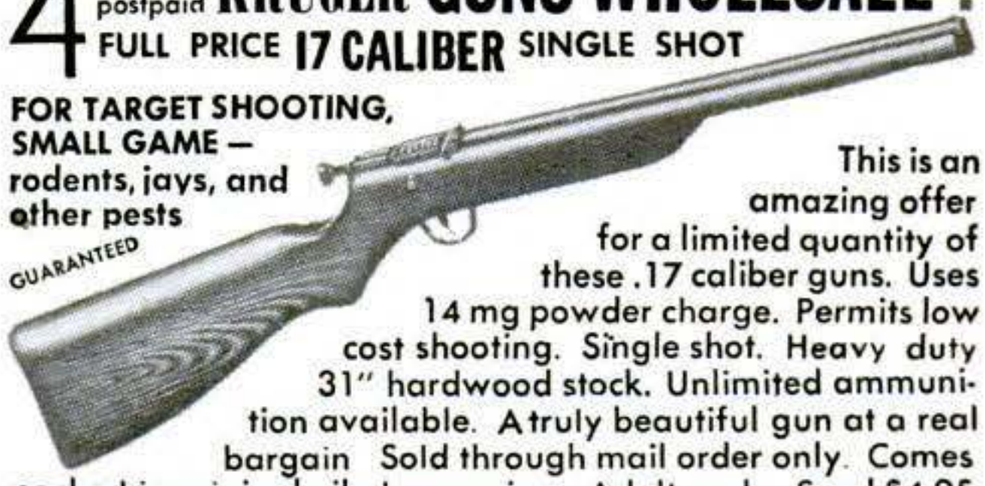

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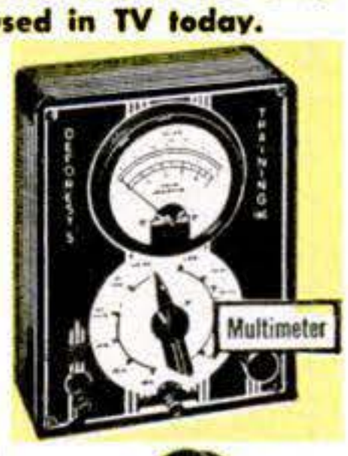

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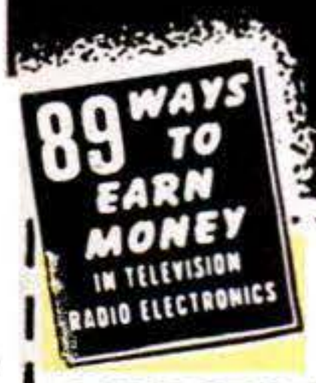

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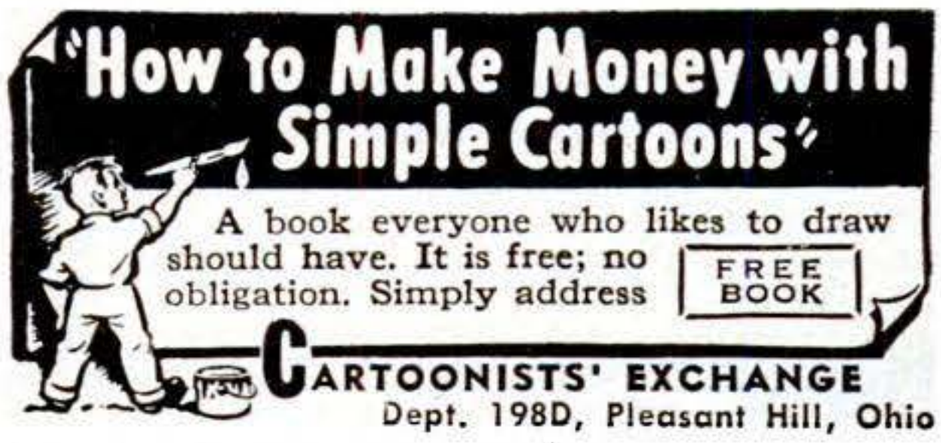

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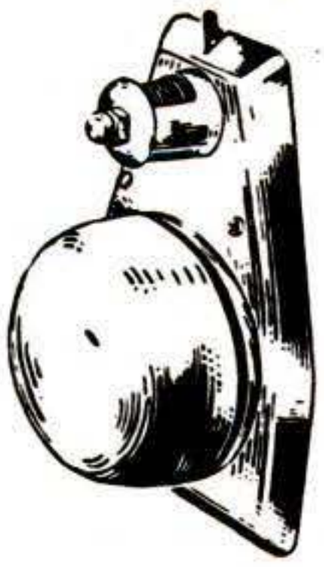

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- ☐ Concrete Construction
- ☐ Sanitary Engineering

DRAFTING
- ☐ Aircraft Drafting
- ☐ Architectural Drafting
- ☐ Electrical Drafting
- ☐ Mechanical Drafting
- ☐ Structural Drafting
- ☐ Sheet Metal Drafting
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ELECTRICAL
- ☐ Electrical Engineering
- ☐ Electrician
- ☐ Electrical Maintenance
- ☐ Electrical Drafting
- ☐ Electric Power and Light
- ☐ Lineman

HIGH SCHOOL
- ☐ High School Subjects
- ☐ College Preparatory
- ☐ Mathematics
- ☐ Commercial
- ☐ Good English

MECHANICAL AND SHOP
- ☐ Mechanical Engineering
- ☐ Industrial Engineering
- ☐ Industrial Supervision
- ☐ Foremanship
- ☐ Mechanical Drafting
- ☐ Machine Design-Drafting
- ☐ Machine Shop Practice
- ☐ Tool Design
- ☐ Industrial Instrumentation
- ☐ Machine Shop Inspection
- ☐ Reading Blueprints
- ☐ Toolmaking
- ☐ Gas—Electric Welding
- ☐ Heat Treatment—Metallurgy
- ☐ Sheet Metal Work
- ☐ Sheet Metal Pattern Drafting
- ☐ Refrigeration

POWER
- ☐ Combustion Engineering
- ☐ Diesel—Electric
- ☐ Electric Light and Power
- ☐ Stationary Steam Engineering
- ☐ Stationary Fireman

RADIO, TELEVISION, COMMUNICATIONS
- ☐ General Radio
- ☐ Radio Operation
- ☐ Radio Servicing—FM
- ☐ Television
- ☐ Electronics
- ☐ Telephone Work

RAILROAD
- ☐ Locomotive Engineer
- ☐ Diesel Locomotive
- ☐ Air Brakes ☐ Car Inspector
- ☐ Railroad Administration

TEXTILE
- ☐ Textile Engineering
- ☐ Cotton Manufacture
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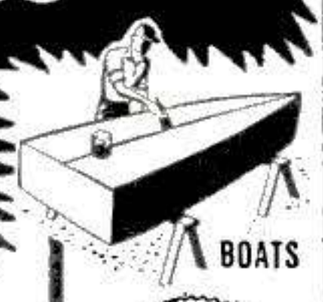

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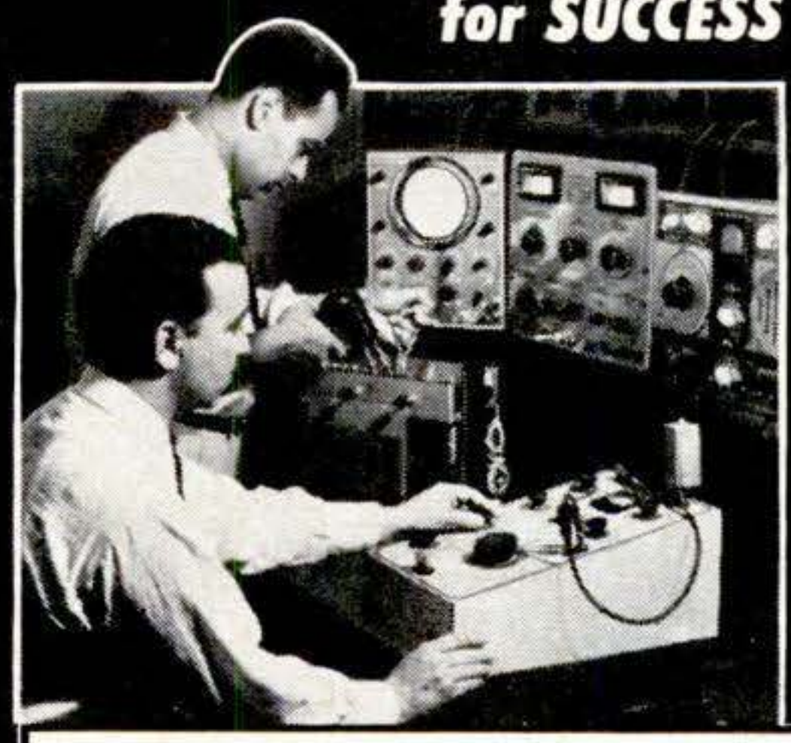

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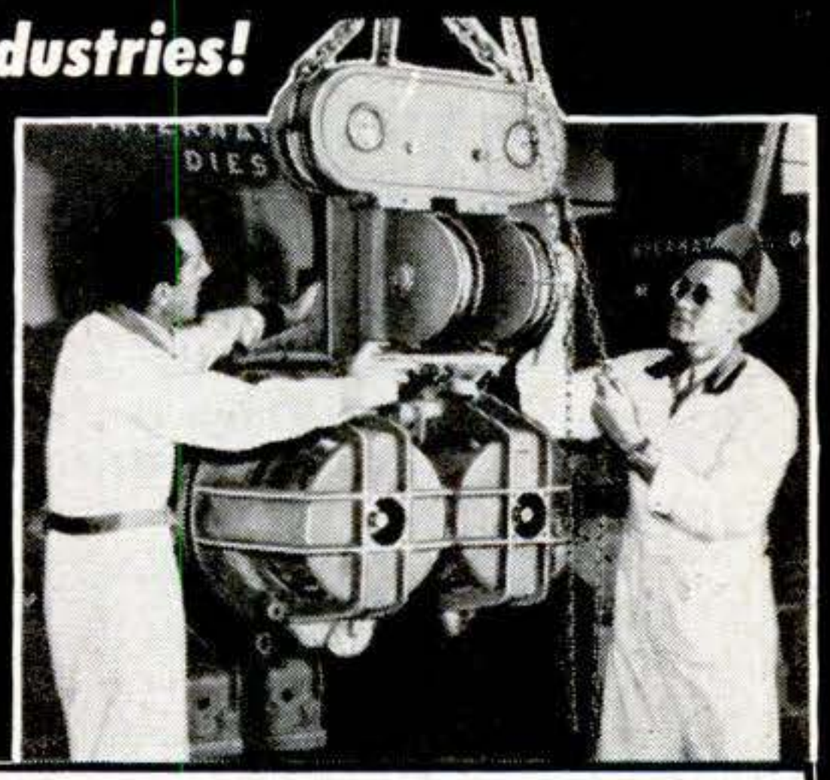

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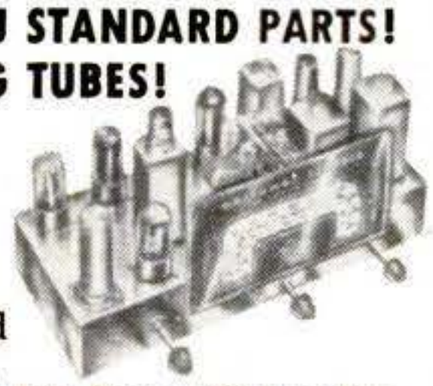

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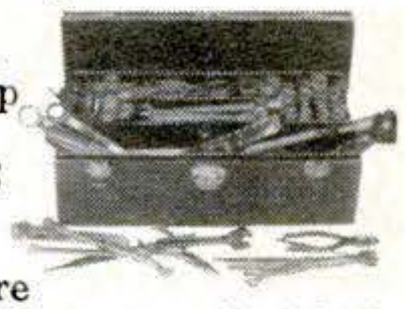

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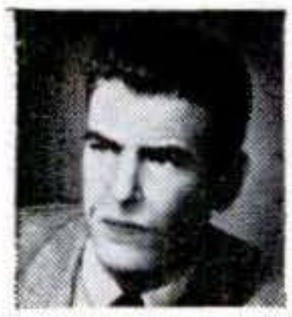

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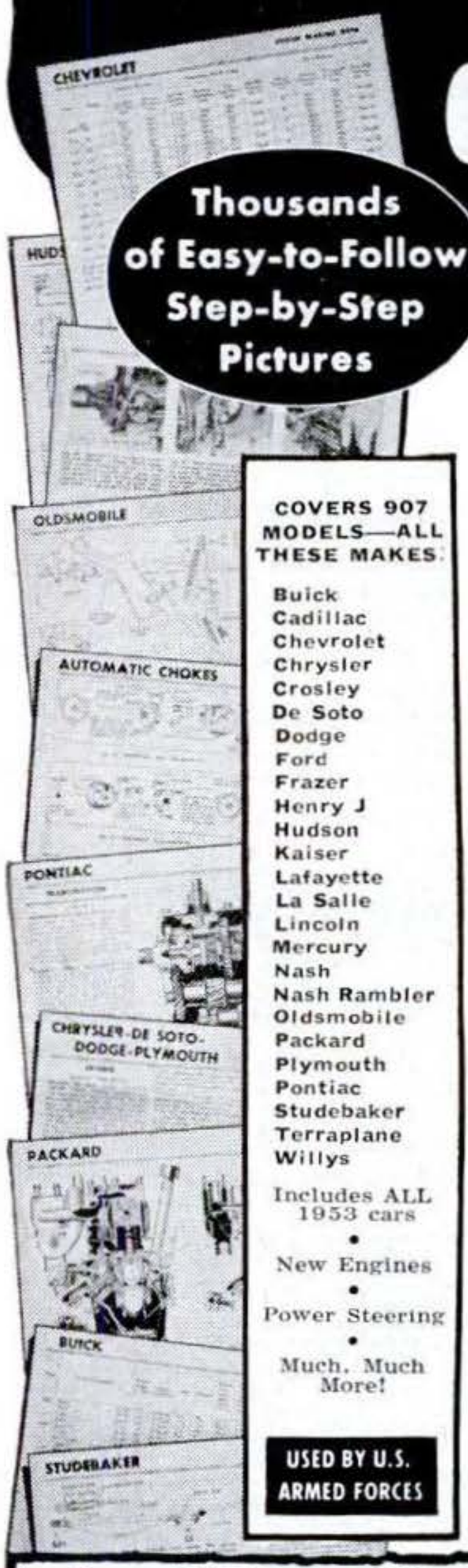

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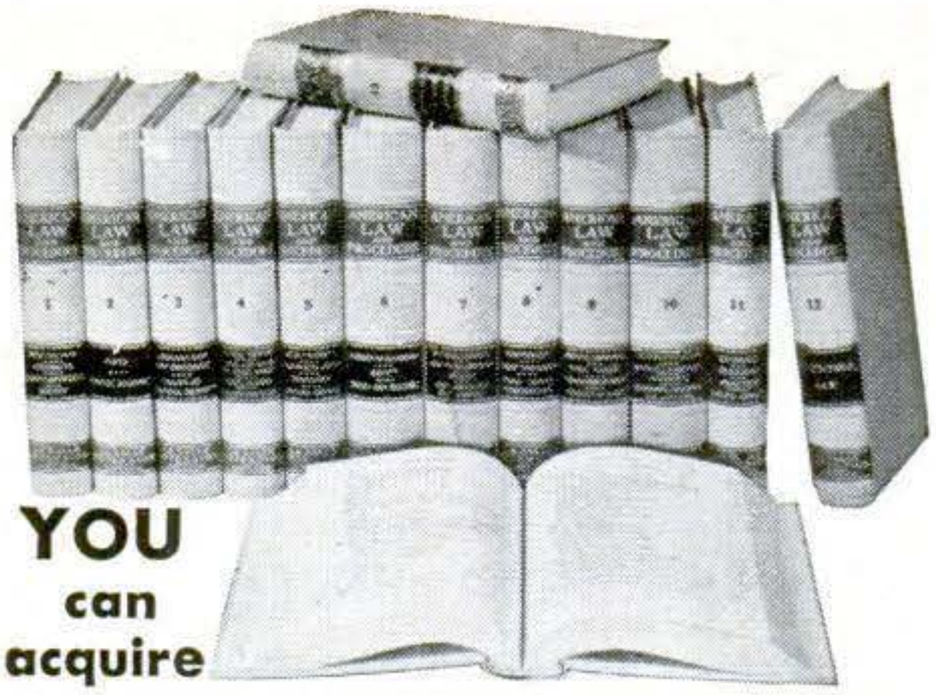

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750x16	12.50	710x15	6.50	32x6(8)	11.95	1000x22	19.50
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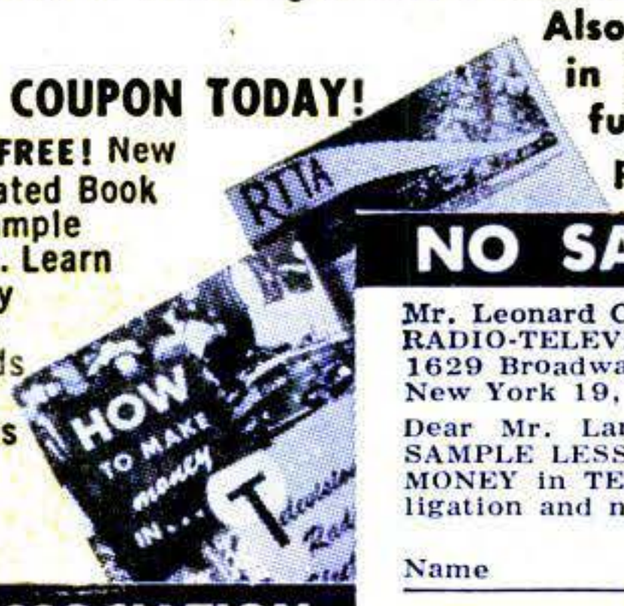

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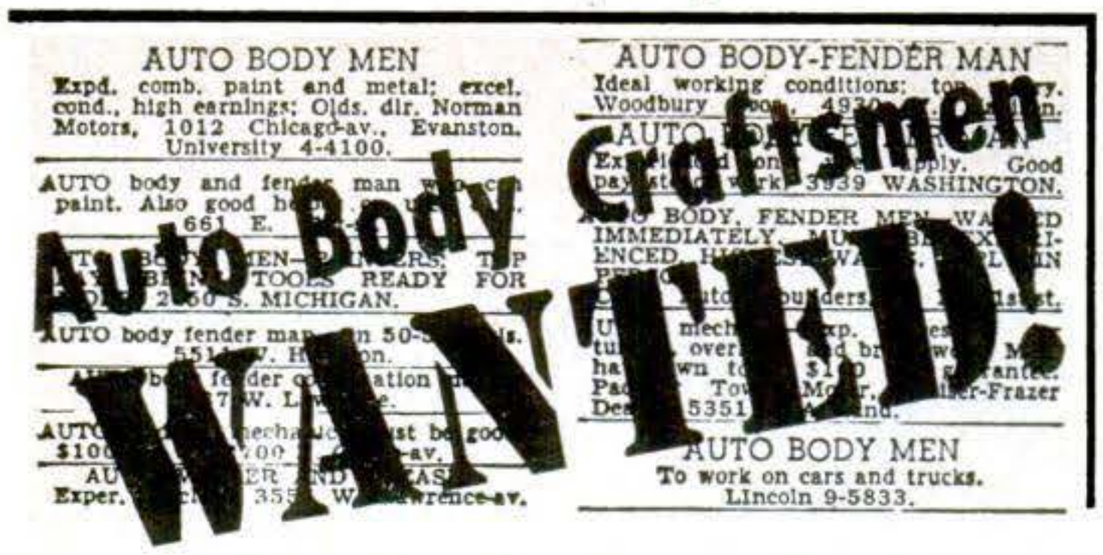

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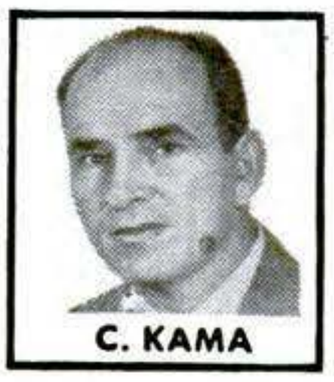
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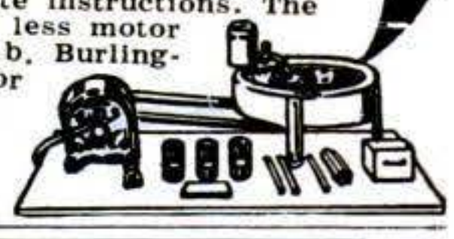

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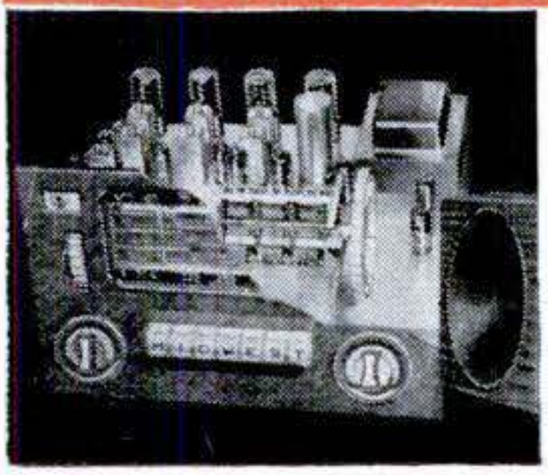

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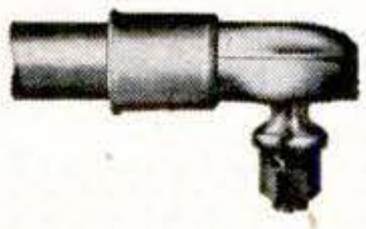

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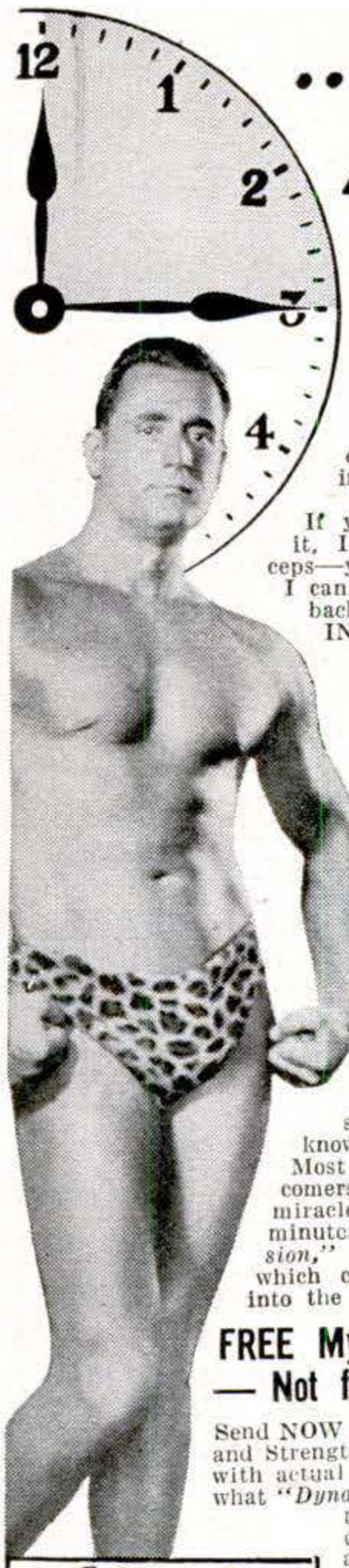

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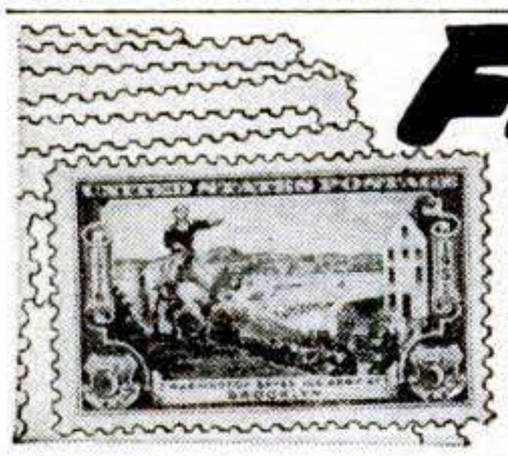

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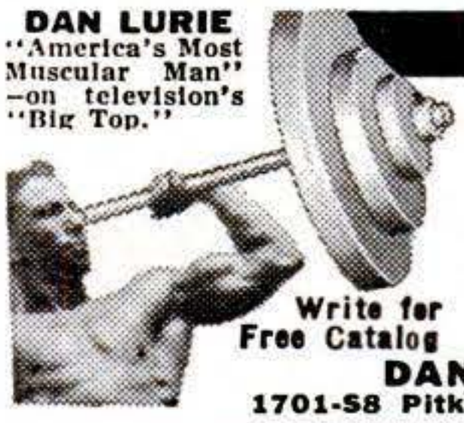

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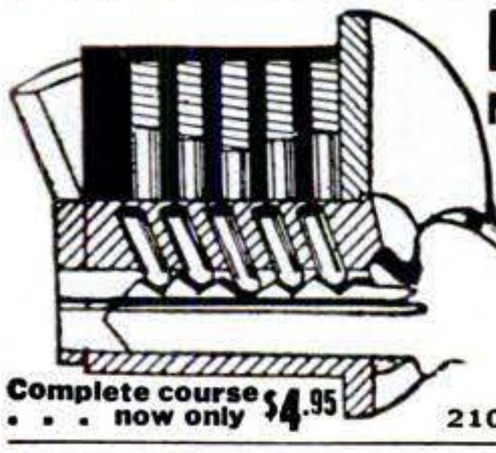

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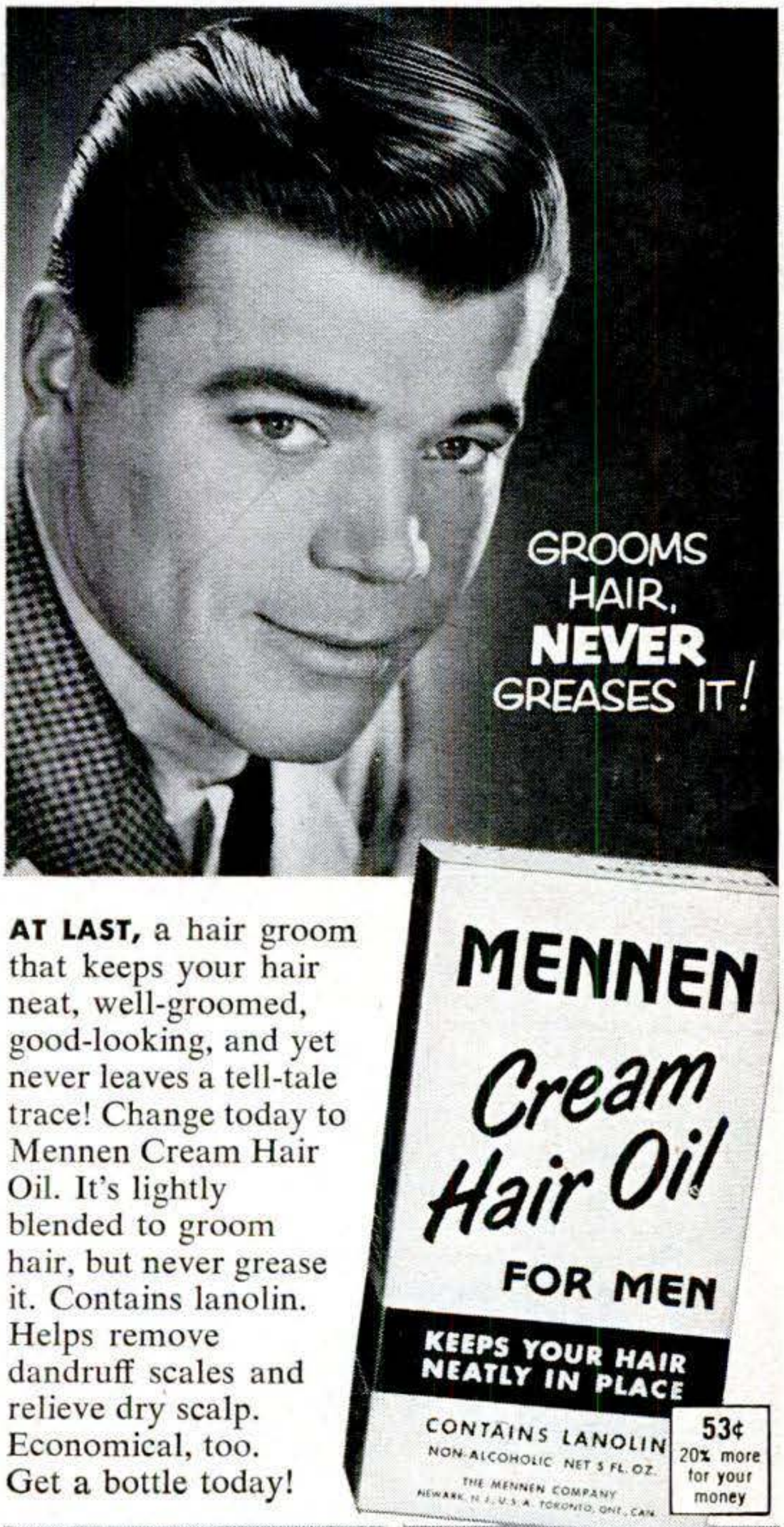

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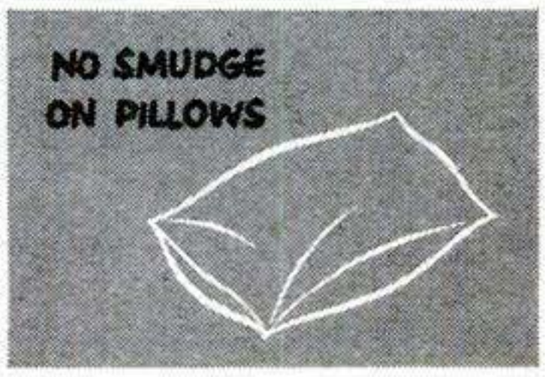

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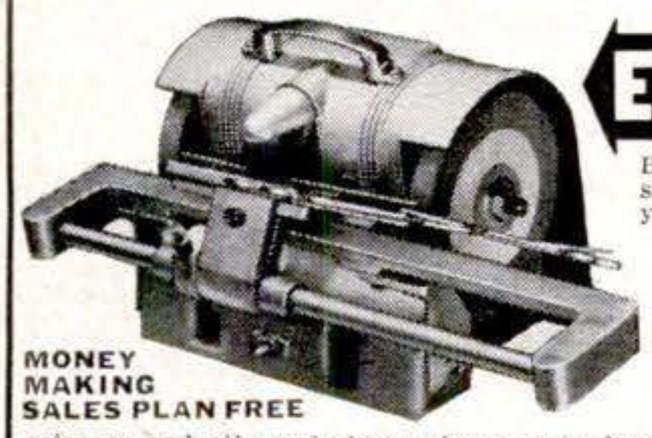

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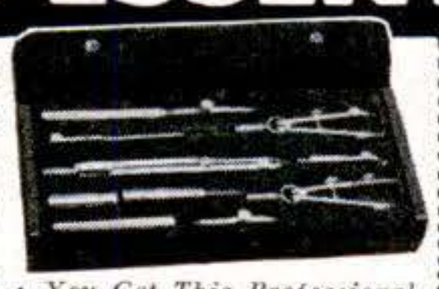

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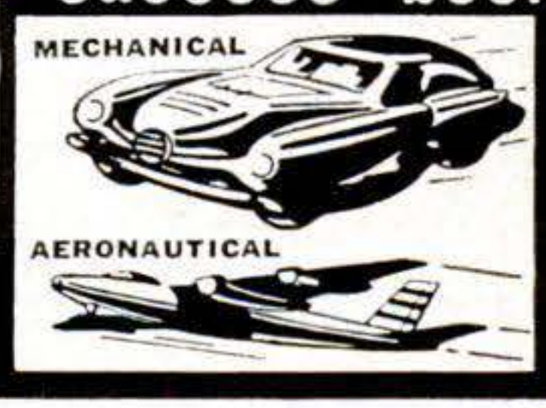

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650-16(6)	7.3[illegible]	710-15	5.75	750-17	11.75	825-20	18.35
700-16	6.45	760-15	6.05	750-15	13.95	900-20	17.25
750-16	9.25	800-15	6.55	825-15	12.95	1000-20	17.75
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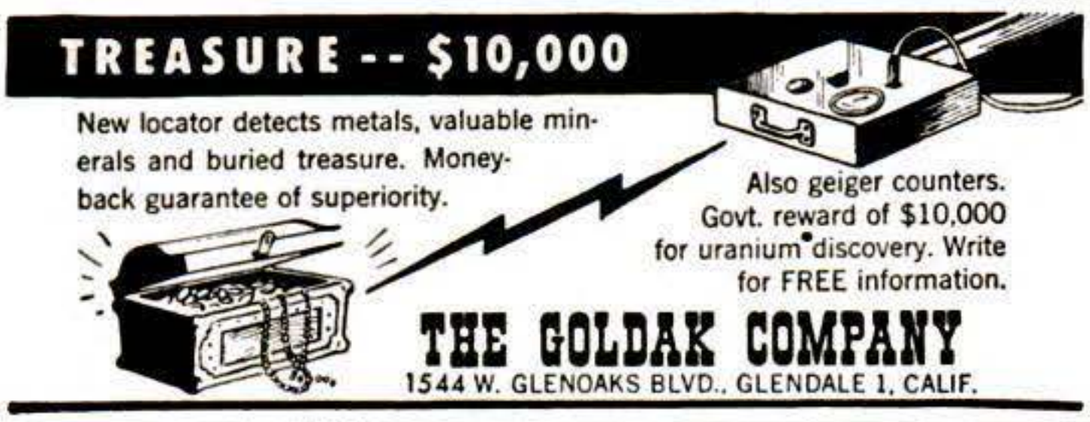

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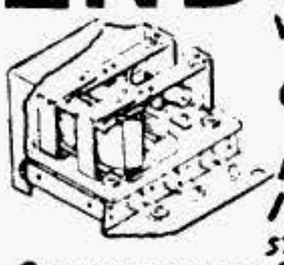

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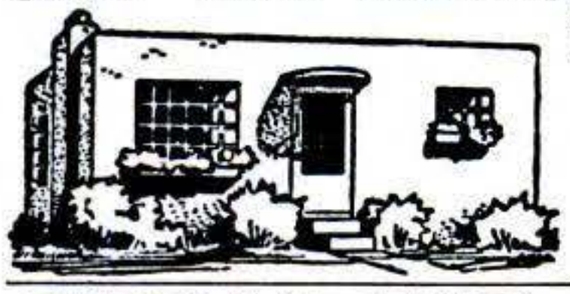

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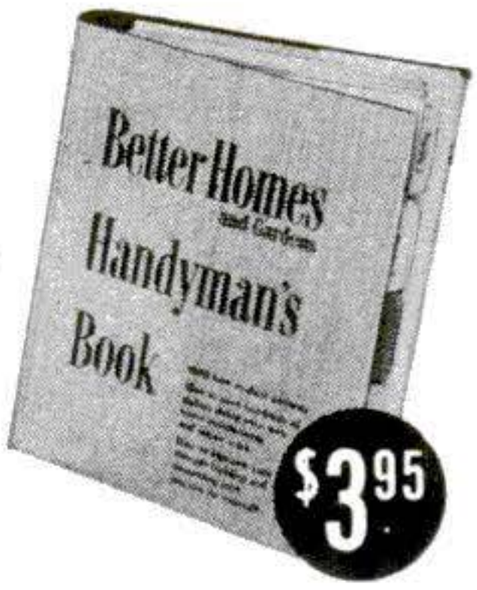

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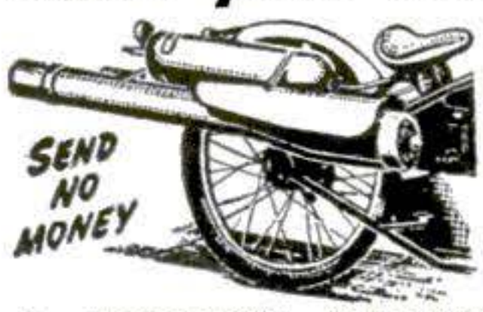

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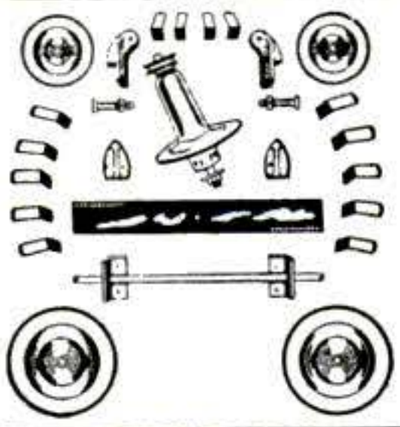

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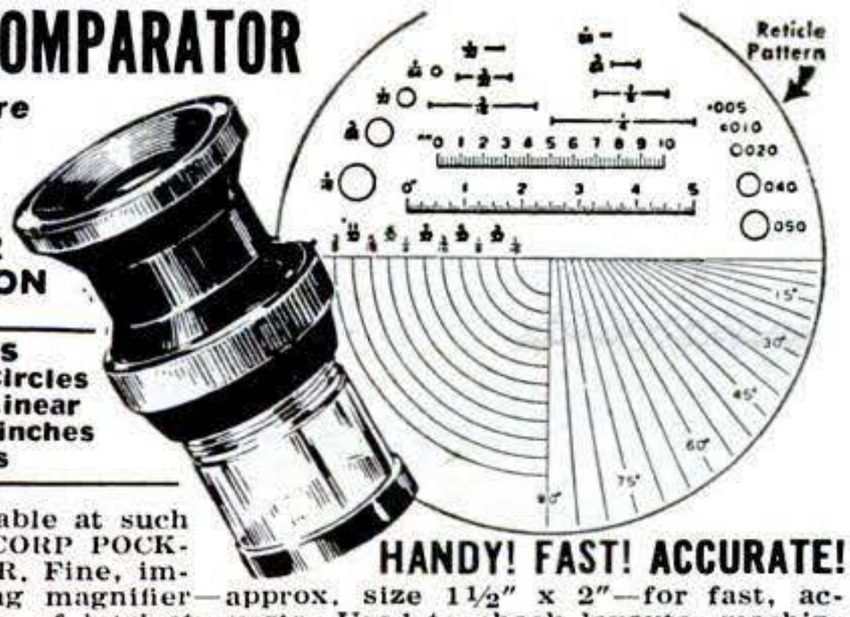

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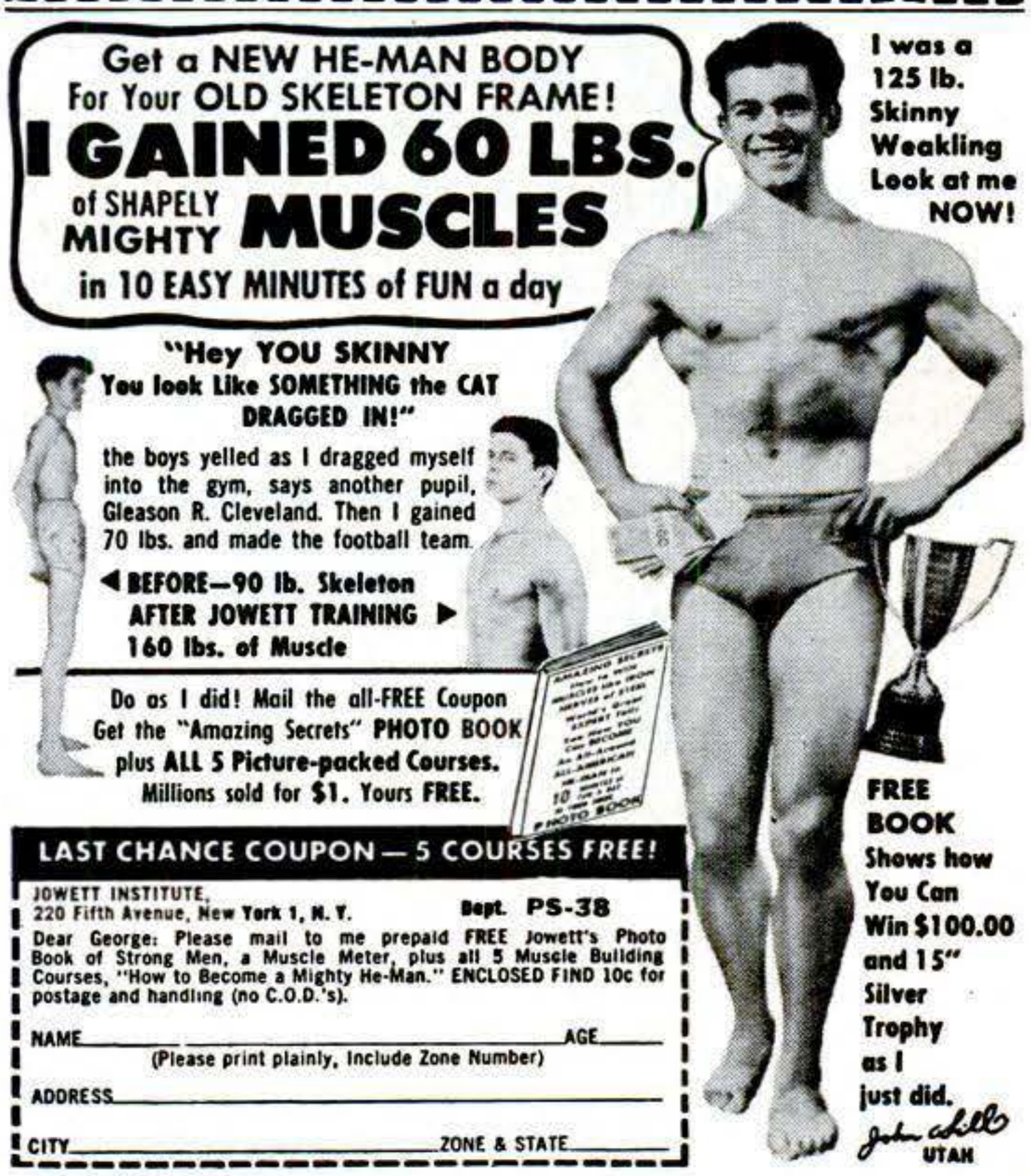

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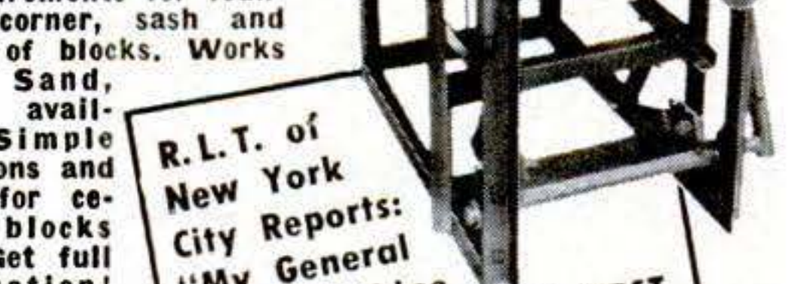

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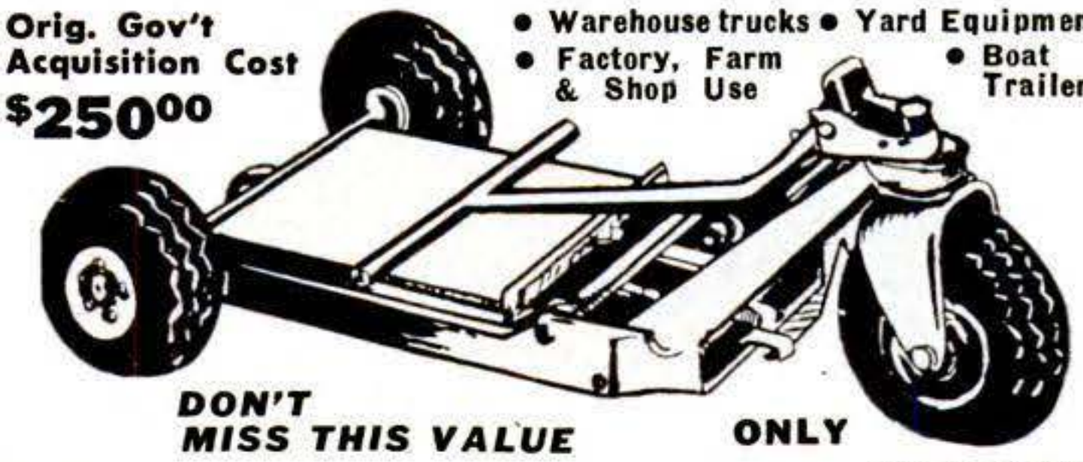

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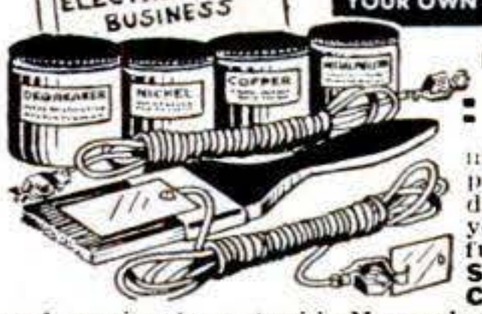

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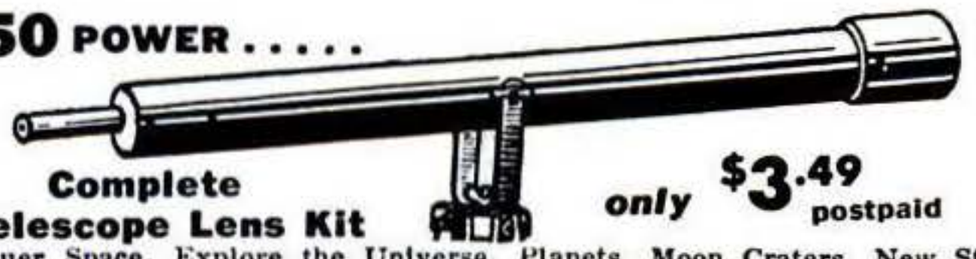

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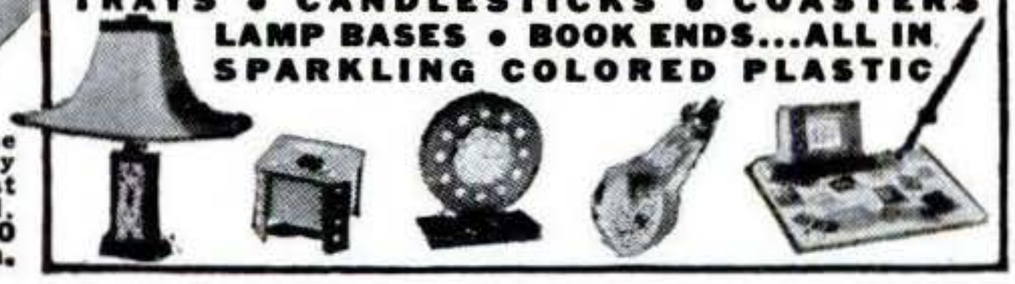

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700-16	4.84	760-15	4.74	700-20	8.24	900-20	13.94
650-15	3.94	800-15	5.04	32x6(8)	8.34	1000-20	13.34
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750-16	6.84	800-15	6.84	700-18	15.84	900-20	17.04
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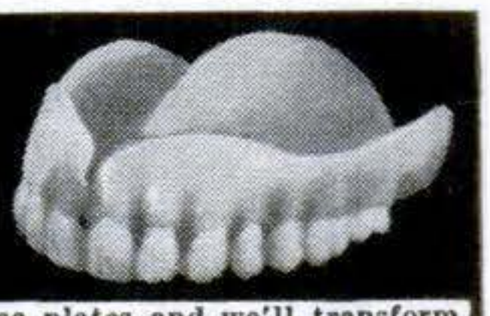

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SCAFFOLDS made with Amidon Fittings and pipe. Amidon Engineering Co., Elyria 4, Ohio.

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EARN $2.00 Hour! I do—making Sandals. Youngs, 1308-PS South First, Arcadia, California.

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38 MONEYMAKING OPPORTUNITIES

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COIN Machines, Spare time. $10.00 start. No experience. $1.00 advises where buy 1000 machines. All kinds. New, used. $2.00 includes information on Licenses, Laws, tips. 2400 W. 24th, Pine Bluff, Ark.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

WE Pay Cash for Boxtops, Labels, Wrappers, Coupons, etc!! Particulars free. Boxtops, PS-983-E Main, Columbus 5, O.

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YOUR ideas are worth big money. Experienced consultants will develop and sell your ideas. Patent protection. Get quick professional results. Send for free information. Scientific Enterprises, Box 2100C, Cleveland 8, Ohio.

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40 PLASTICS

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SPECTROSCOPE for quick chemical analysis $3.00. Book 200 electric stunts $1.00. Cutting Sons, Los Altos, Calif.

ILLUSTRATED Catalog: Chemistry, mineralogy, biology 10c. Tracey Laboratories, Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical, and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N. Y.

AMAZING New Book of Science, Experiments, Formulas and catalogue of Laboratory Supplies. Only 25c. National Scientific Co., Dept. 15, 2204 W. North Ave., Chicago 47, Illinois.

42 HELP WANTED

FOREIGN & Latin American Employment 1953 "Foreign Service Directory" gives Up-To-Minute Facts on Military & Civilian Construction, Government Jobs, Major Oil Listings, Aviation, Transportation, Steamship Lines, Mining, Importers, Exporters, How-When-Where to apply, application forms. Hot List Firms Hiring, $1.00 postpaid. Global Reports, Box 883-S, Hollywood 28, Calif.

ALASKA!! Last American Frontier. $1.00 brings 1953 Business Directory & Government Map. Military & Civilian Construction; Homestead & Highway facts; Mining, Aviation, Fur Farming, Grazing, Timber, Travel directions. List of firms hiring. How to apply. Alaska Opportunist, Box 92-S, Hollywood 28, Calif.

ADDRESS and mail postcards. Make over $50 week. Send $1 for instructions. Lundo, Watertown, Mass.

FOREIGN — Employment Construction Work. If interested in foreign projects with high pay, write Foreign Service Bureau, Dept. PS, Metuchen, New Jersey.

LADIES: Address Folder Cards Spare Time! $40 Weekly possible! Enclose stamped addressed envelope; write Folders, Tillar, Arkansas.

GIANT overseas job list: How, When, Where leads. New lists weekly. $1.00 postpaid. Universal Publishers, Box 2446-A, San Francisco 26, California.

PHILADELPHIA, Baltimore, Washington, D.C., Help Wanted Columns mailed. One of each $2.00. R. Pyles, 561 N. 63rd St., Phila., Penna.

SAN Francisco Help Wanted and Business Opportunities Columns, two papers. One dollar air-mailed. Burkett, 730 Eddy.

NORTHERN airbase construction opportunities! Transportation paid. Laborers earn $255 weekly, skilled $340. Complete information, wages, overtime, conditions, how to apply, etc. Plus, latest weekly bulletin, "Firms Seeking Applicants". Everything, $1. Jobservice N-1, Box 30, Billings, Montana.

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CONSTRUCTION Job List. Published Monthly. $1.00. Dempster's Construction Scout News, Dept. 268-NO, Bridgeport, Ill.

FOREIGN Jobs. Contracts underway and soon starting in Africa, South America, Canada, England, Europe, South Pacific, Middle East, Mexico and Alaska. Send $1.00 for foreign job news, information, application forms, etc. DCS Foreign Job News, Dept. 268-NP, Bridgeport, Ill.

43 AGENTS WANTED

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NEW Jobs open in selling! Send name, address for five free issues of Opportunity Magazine's money-making guide, listing hundreds of companies who'll pay you well, full or part-time. No experience needed. Opportunity 28 E. Jackson, Dept. 18, Chicago 4, Illinois.

BE A Money Maker . . Use your home as magazine headquarters. Liberal commissions. No experience—No capital needed. Everything furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510A, Mount Morris, Illinois.

AGENTS—300% profit selling genuine gold window letters; stores and offices. Free samples. Metallic Sign Letter Co., 431-E North Clark, Chicago.

WHERE To Buy 800,000 articles direct from manufacturers at wholesale prices. Send name, address for free outline. Glass Publishing Company, Ellwood City 8, Pa.

ABSOLUTELY Free—Sales Kit. Yours for the asking. Send postcard today requesting kit showing new line, belt buckles with your name or personal initials, cap badges, choice 3000 different emblems. Write Hook-Fast, Box 1425PS, Providence, R. I.

ADDRESS and mail postcards. Make over $50 week. Send $1 for instructions. Lundo, Watertown, Mass.

GOLD, Silver lacquered letters. Windows, doors, trucks. Standard sizes. Penny and up. Big profits. Samples. Atlas-E, 544 West 79th, Chicago 20.

SALESMEN—make up to $50 in a day selling brand new item going to every type of food and beverage store, factories, laboratories, hospitals, etc. Samples Furnished. Utility Durawear, 53 West Jackson Blvd., Dept. PS-8, Chicago 4, Illinois.

AT Last! Something New and Sensational in Christmas Cards. Make Extra Money Fast! Show Satins, Velours, Metallics. Gets Easy Orders. Pays up to 100% Cash Profit. 30 Free Samples. With Name 50 for $1.50. Big Line. Amazing new Glo-In-The-Dark Ornaments. Personalized Matches, Stationery. Several $1.00 Boxes on Approval. Euro Greetings, 2801 Locust, Dept. 341-K, St. Louis, Mo.

MONEY For Xmas. Make at least $50 showing beautiful Elmira Christmas and All-Occasion Greeting Card Assortments—Name Imprinted Christmas Cards, Stationery, Napkins, Book Matches, Playing Cards—Gift Wraps, Books, Games, Household, Hostess Items. All unbeatable values. Make money while you make friends. No Experience Necessary—No Risk—Send No Money. Free Samples, Catalog, Bonus Plan, Display Assortments on Approval. Write Today! Elmira Greeting Card Co., Dept. C-177, Elmira, N. Y.

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START Your Own Business on credit. Your own boss 1658 of our Dealers sold $5,000 to $27,500 in 1952. We supply stocks, equipment on credit. 200 home necessities. Sales experience unnecessary. Pleasant, profitable business backed by world-wide industry. Write Rawleighs, Dept. H-U-PSC, Freeport, Ill.

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DROP everything! Sensational earnings now to Christmas with fastest-Selling, popular-priced personal Christmas Cards, name-imprinted. Also album of deluxe designs. Box assortments, too. Send name for samples. Wallace Brown, 225 Fifth Ave., Dept. F-4, New York 10, N. Y.

1953—WHOLESALE Dealer Kit on appliances, typewriters, recorders, cameras, giftware, lighting fixtures Free. Write Arrow Distributing, 154J, Nassau St., NYC.

JUST Out! New Thrilling Sensation in Christmas Cards. Make Big Money! Show Lustre Foils, Satins, Brilliants. Amazing Values bring Easy Orders! Magic Glo-In-The-Dark Ornaments. Personalized Stationery, Matches. 30 Free Samples. With Name 50 for $1.50. Several $1.00 Boxes on Approval. Joy Greeting, 507 N. Cardinal, Dept. 61-L, St. Louis Mo.

$200 WEEKLY. New invention. Amazing 4-second Presto Emergency tire chains, fit all modern auto wheels. National advertising building big demand. 3 sales daily to oil stations, dealers, etc., make $200 or more weekly. Territory going fast. Write Presto Chain Co., Dept. P-25, Des Moines 2, Iowa.

CALENDARS. Advertising Novelties, Matches. All styles, including Religious, Varnished, 12 sheet, Girls. Hundreds of Advertising Novelties. Book Matches, etc. Fleming Calendar Co., Promotional Division, 6539 Cottage Grove, Chicago 37, Ill.

MAKE $50, $75, $100. More! Sell new, different Christmas, All Occasion greeting cards. Big profits. New bonus reward. Experience unnecessary. Write for Feature samples on approval, free samples Name Imprinted Christmas Cards, exclusive Stationery, free color illustrated Catalog, Selling Guide. New England Art Publishers, North Abington 833-C, Mass.

AMAZING Profits selling Exclusive Sunshine Christmas Cards: Nature Prints, Scripture Text, Imprints, Nationally Famous 21 for $1.00 assortments all sell on sight! Many Others! Also Gift Wraps, Stationery, etc. Send for samples on approval. Sunshine Art Studios, Inc., Dept. PS-8, Springfield 1, Mass.—Pasadena 3, California (Note: East of Rockies address Springfield office.)

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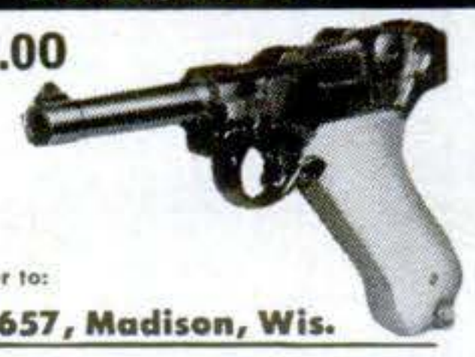

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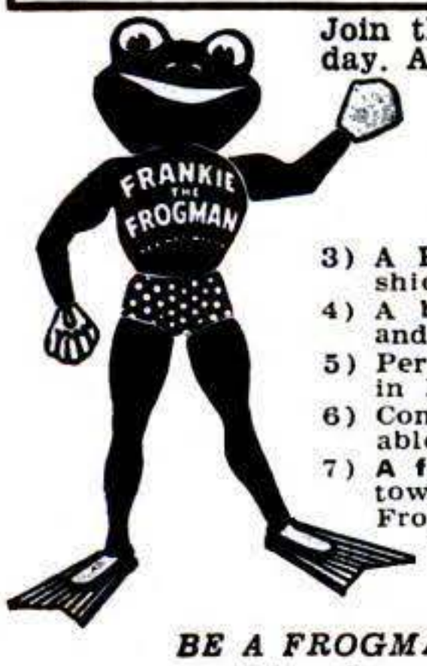

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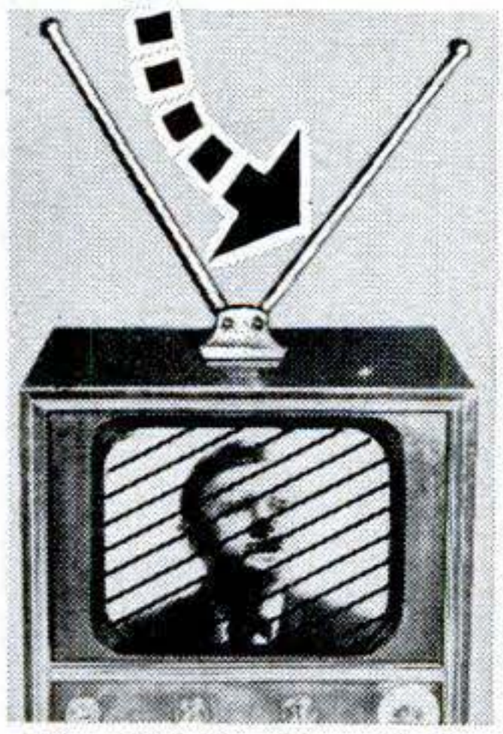

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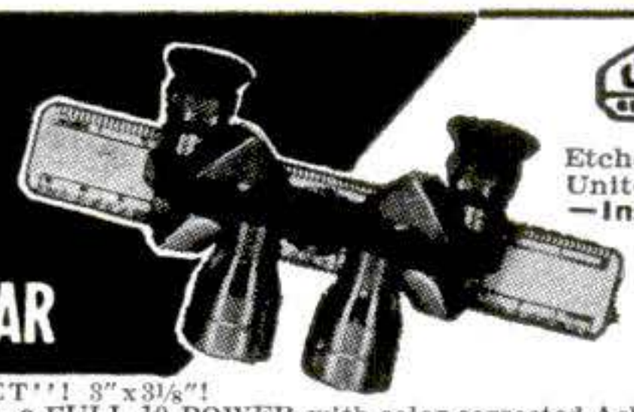

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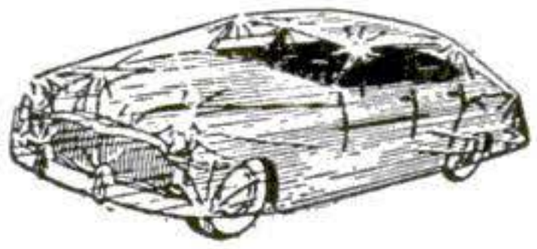

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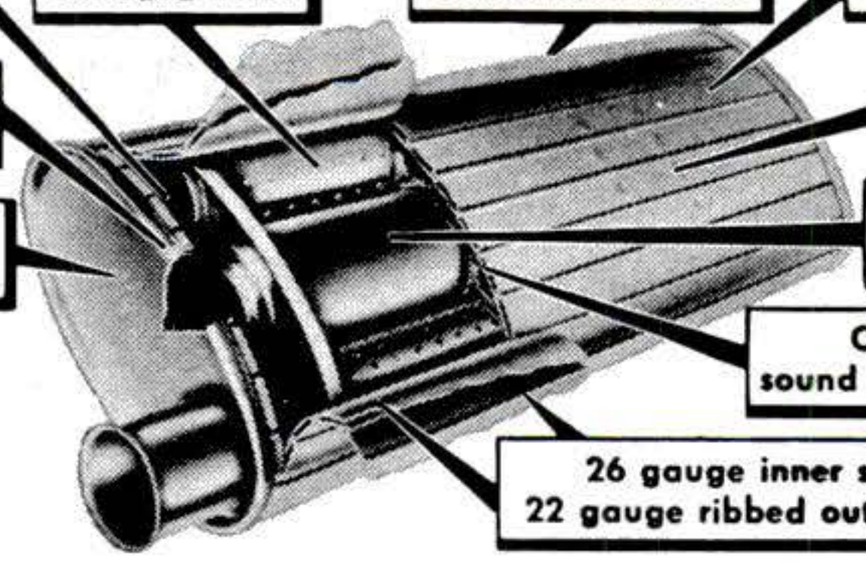

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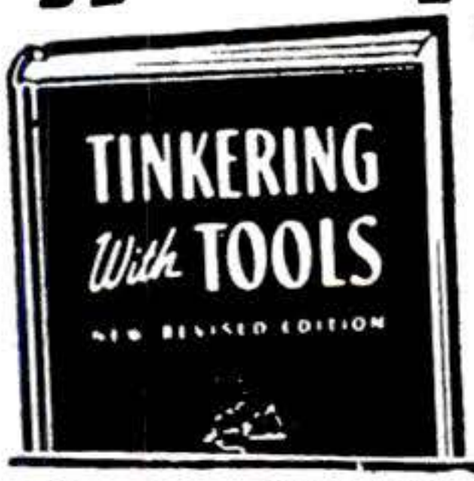

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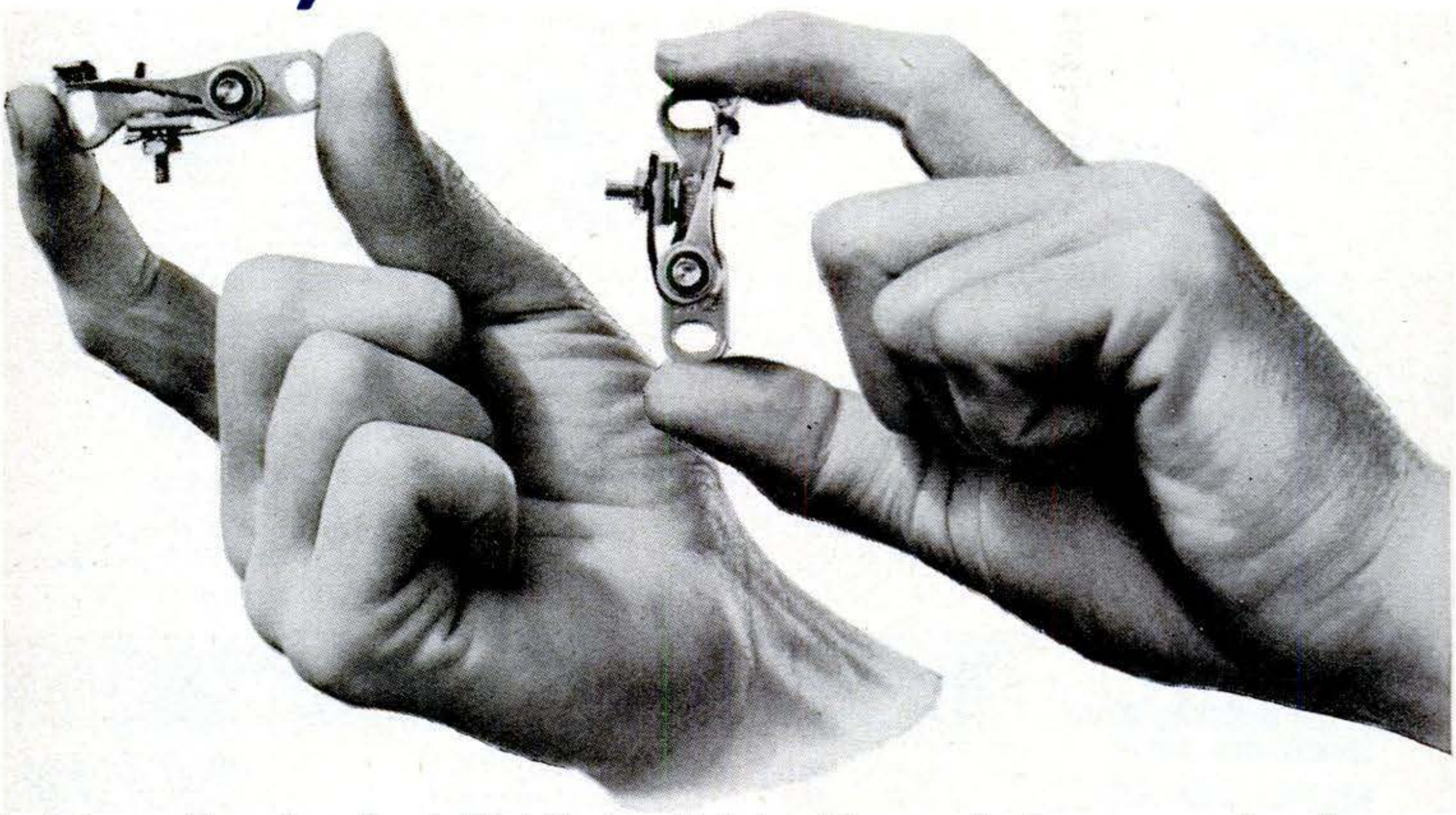
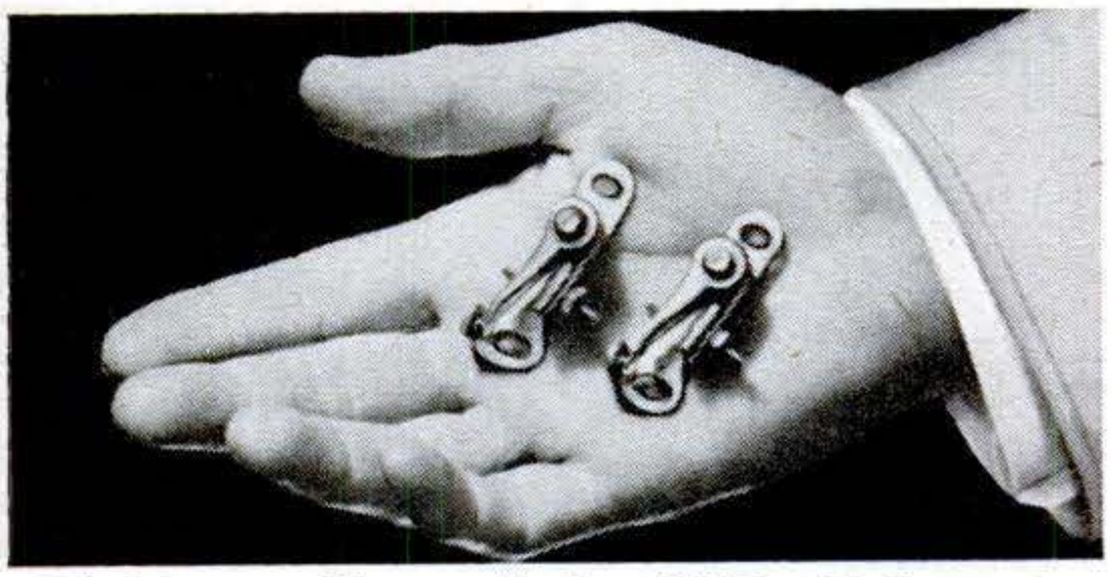
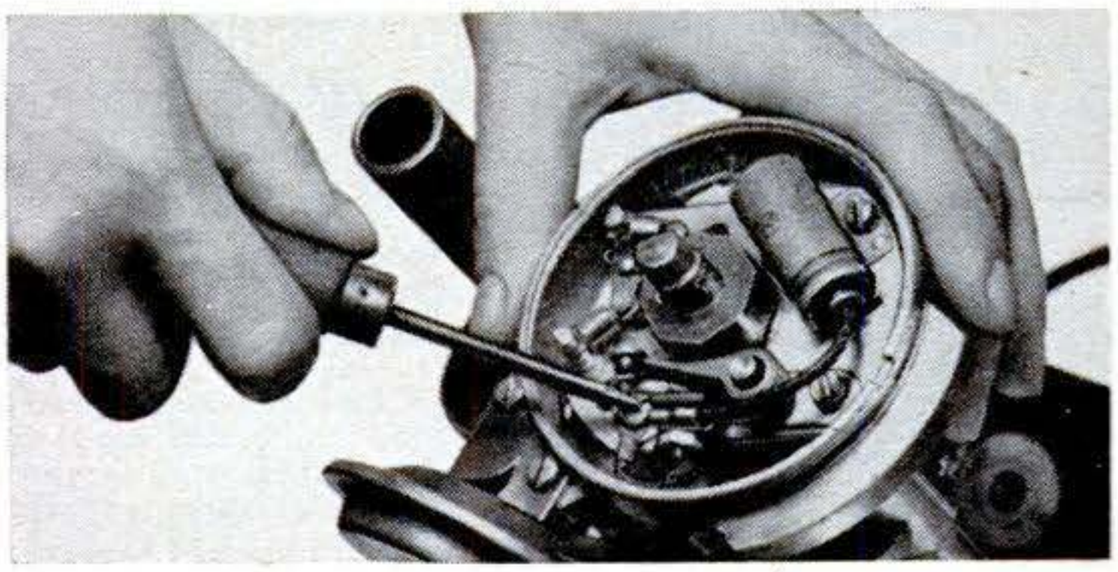


Insist on Genuine Ford Distributor Points. The contacts are made of pure tungsten . . . to exact Ford tolerances. They help give your Ford new-car power.



Mighty small, aren't they? Yet if these tiny Distributor Points are worn or faulty, your engine may misfire or not run at all. You see, they help build up the spark that sets fire to the gas in your engine. Every mile you travel, they make contact 12,000 times—around 120 million times in an average year's driving!



Pure tungsten is about the only metal that can stand up under this wear and tear . . . and also conduct the high voltage (15,000 volts) necessary to operate your Ford's ignition system. And you can be *sure* that you're getting *pure* tungsten points when you ask for Genuine Ford Distributor Points.

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POPULAR SCIENCE
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Captain Bullock in his Stratocruiser.

He Recaptures Aviation's Good Old Days

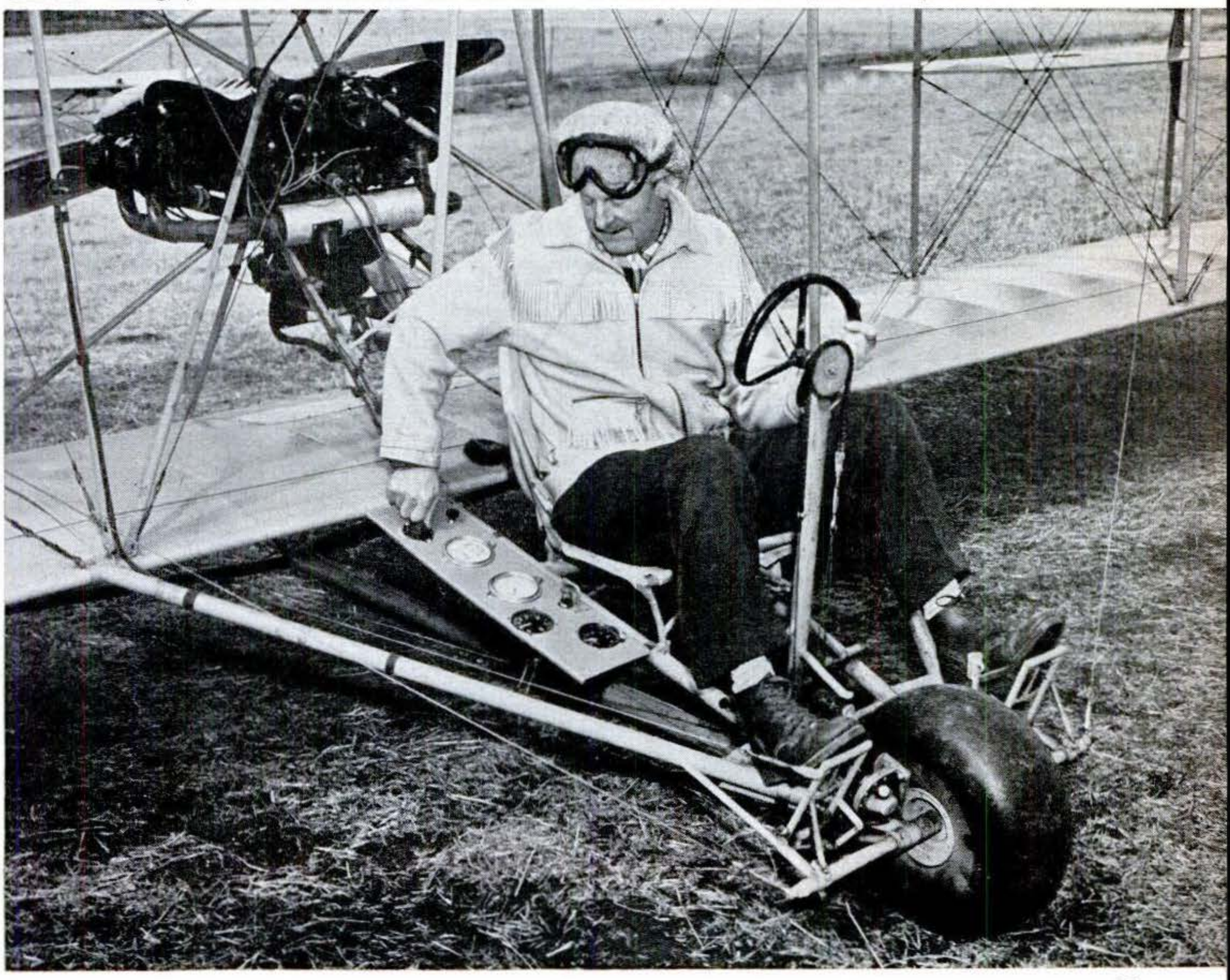
"Flying by the seat of his pants" in old-type crate is fun and relaxation for pilot of giant airliner.

By Wesley S. Griswold

IN LAKEVILLE, Minnesota, people look up at the sky when they hear what sounds like an outboard motor running at full throttle. A 1911-model yellow airplane is likely to come sailing over the trees, bouncing and fishtailing in the invisible billows of the air like a big box kite.

When a control-tower operator at a nearby airport first saw this strange

SOMETHING HAS BEEN ADDED to the original Curtiss design, which afforded no instruments at all. The wheel and chain came from a crashed twin-engine Army Beech.



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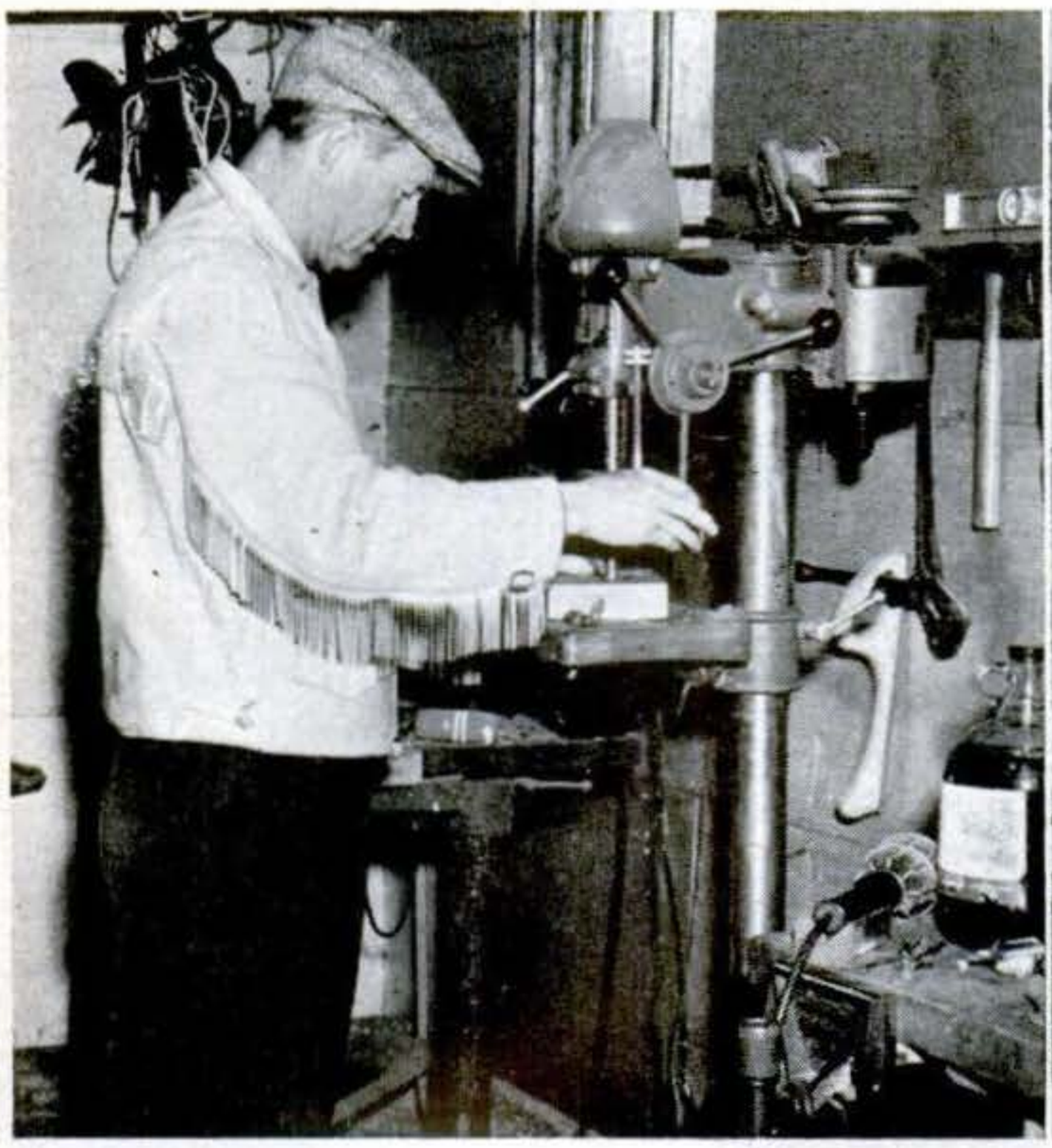
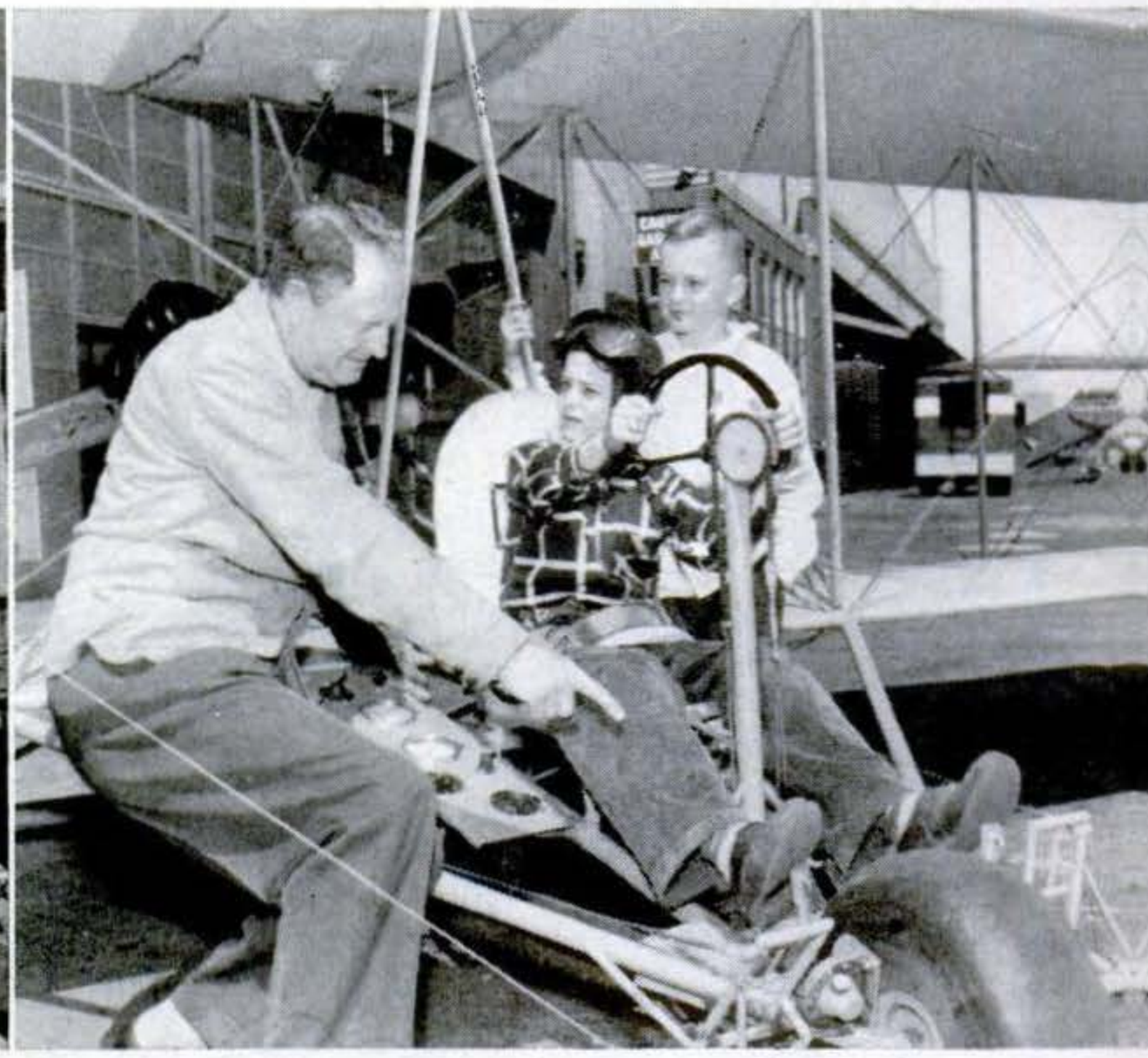
FOR SAFETY'S SAKE, Captain Bullock wires cap screws on plane's gasoline gauge. Note air scoops on engine. He found them necessary even though engine is fully exposed.



CUTTING OUT GASKETS on the drill press in his barn workshop, where Captain Bullock built the wings for his Curtiss and also constructed all the cabinets for his farmhouse.



THE RACING GRANDPA, as the press called Bullock when he entered the 1946 Bendix Race, points out brake pedals to two of his three grandsons. Big pedals control the rudder.

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"It Looks Mighty Unsafe," Says Mrs. Bullock

craft moving towards him, he shouted over the public-address system, "Take to the hills, men! Here come the Wright brothers."

The Wright brothers, however, wouldn't have been caught dead in this plane. It was designed by Glenn H. Curtiss, at a time when he was their bitter rival.

Now the plane belongs to Capt. Walter R. Bullock, of Northwest Airlines, a tall, rugged man of 53 with ruddy face, blue eyes and graying hair, whose portrait is one of 10 in U. S. Aviation's Hall of Fame in Washington.

Bullock's flying machine is a copy of a Curtiss pusher that he owned as a teen-ager. He made it out of second-hand parts from several modern airplanes and wings that he built in his barn workshop at Lakeville.

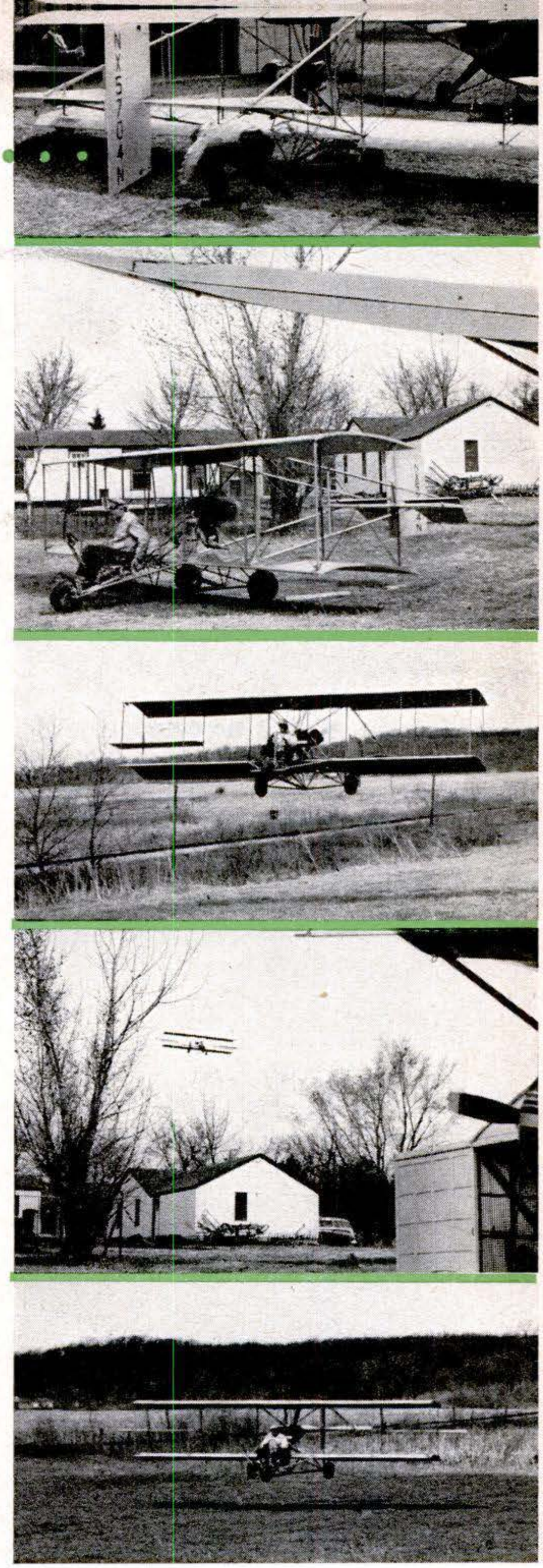
Recaptures Original Thrills

This summer, with old rivalries long forgotten, Bullock's Curtiss will take part in the nation's observance of the fiftieth anniversary of the Wright brothers' first flight.

Captain Bullock, who has about 24,000 hours of flying to his credit, regularly pilots a Boeing Stratocruiser between Minneapolis and Seattle. At the end of each homeward flight, he descends from that mammoth, 130,000-pound airliner and usually heads for his Lakeville farm and the 600-pound Curtiss. In it, all alone on a canvas seat out in front of the wings, he recaptures the original thrills and real fun of flying.

It's an enthusiasm that Mrs. Bullock emphatically doesn't share. Her husband literally flew into her life, one February day in 1922, when he made a forced landing on her father's Wisconsin farm. She would prefer that he not fly out of it.

"When he's up in that pusher," she says, "all I can think of is that he's sitting in a little chair a thousand feet above



ROUTINE BULLOCK FLIGHT is shown in series of photos above (top to bottom). Starting the hard way, spinning the pusher prop by hand. Ready to roll, he fastens safety belt. Airborne in 100 feet, he then soars over the trees. A perfect landing ends the flight.

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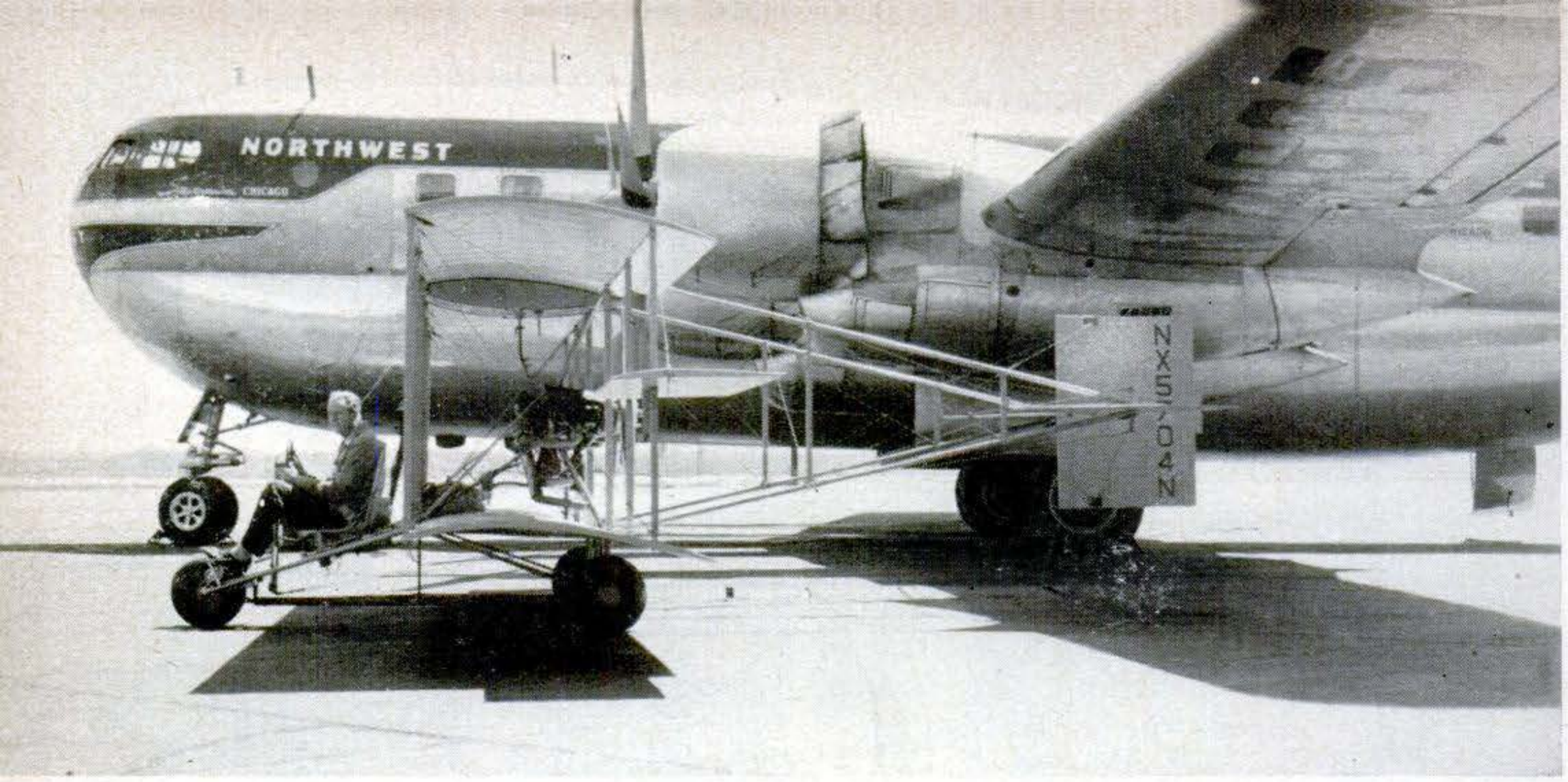

Pilot Bullock poses in Curtiss biplane beside the big Stratocruiser he flies for a living.

my head. . . . It looks mighty unsafe."

Bullock is inclined to pooh-pooh the hazards. The plane, powered by a 75-horsepower Continental aircraft engine with a pusher propeller, takes off in 200 feet or less, and he can set it down on almost any clear and reasonably flat surface. Its stalling speed is a gentle 38 miles an hour.

Have to Fly It Every Second

He has flown the pusher for nearly 60 hours since he finished it, and he probably would have flown it a good bit more if it were not for the fact that his life insurance becomes null and void while he's up in the plane. The Curtiss is licensed as experimental, and Bullock's policies don't cover participation in such shenanigans.

"The plane handles easily," he says, "though I don't suppose you could exactly call it stable. You have to fly it every second. It's so slow that gusts of wind make it lose a lot of flying speed. If the gusts come too often, it tends to settle, and I have a devil of a time keeping it in the air. But it sure is fun. Boy, you can *see* so much!"

Bullock, a Minneapolis boy whose father was a stockbroker, caught the flying fever early. He built models of Wright, Curtiss and Langley planes when he was a schoolboy. When he started in earnest to reproduce one of them full-scale in the back yard, his parents sent him to the Curtiss company's flying school at Newport News, Va. There, in the late fall of 1916, after 486 minutes of instruction at $1 a minute, he became, at 17, the youngest licensed pilot in the U. S.

In honor of this event, his indulgent father planked down $900 for a semi-wrecked 1911 Curtiss pusher and presented it to him. Walt rebuilt it, under Curtiss supervision, and even learned to loop it.

To Bullock's deep regret, he didn't get to fly during World War I, when he enlisted in the Army. Once out of uniform, however, he started barnstorming around the country in a series of Curtiss Jennies.

Ran Flying School

During the early Twenties, Bullock ran a flying school in Minneapolis, and on weekends took curious hangers-on up for short flights at $25 a head. In 1927 he became a pilot for Northwest Airlines, a year after the company was formed, and is today its most distinguished captain.

During World War II, Bullock did valuable icing research for the Army Air Forces, and was among several vet-

[Continued on page 222]

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Come On In, Mom —the Paper's Fine

THAT's right, Mom and the kids are wearing bathing suits of paper that won't tear even when wet. The suits were made to show the ruggedness of paper coated with Melostrength, a resin developed from melamine by American Cyanamid. In tests, a wet, inch-wide strip of coated paper supported a 13-pound block of concrete and a treated freezer-pack paper was boiled continuously for 72 hours without disintegrating.

▶▶▶With a new kind of sunglasses you can look at a red light and see red, or walk over green grass and see green. Colors are as true as when viewed with the naked eye, except that they appear less intense due to the filtering effect. Yet the neutral gray lenses absorb all but 15 percent of the sun's light, including the ultraviolet rays that tire the eyes most when the day is spent outdoors. The Ray-Ban glasses were originally developed for the Navy but now are available to civilians. Bausch & Lomb makes them.

Barbecue Cooks Meat Sideways

HERE's a portable barbecue grill with a vertical firebox that holds the charcoal in place behind a mesh wall. Cooking juices drip into a saucepan instead of into the fire so they can be used for basting the meat or preparing gravy.

The drip pan also catches grease splashes that might burn the chef or cause a sudden flare-up of the fire. The Bar-B-Grill is made by May & Scofield, Howell, Mich., and sells for about $8.

Cruiser Has One-Piece Bottom

THE hull of the Paragon Express 21, below, is without a seam from gunwale to gunwale. Along with the trunk cabin, canopy and transom, it's made of molded plywood. She's the first inboard cruiser with this type of construction—which never requires caulking or preswelling and resists worms and dry rot, according to the Paragon Marine Construction Co., of North Miami Beach, Fla. The craft's 60-horse Chris-Craft drives her at 20 miles an hour.

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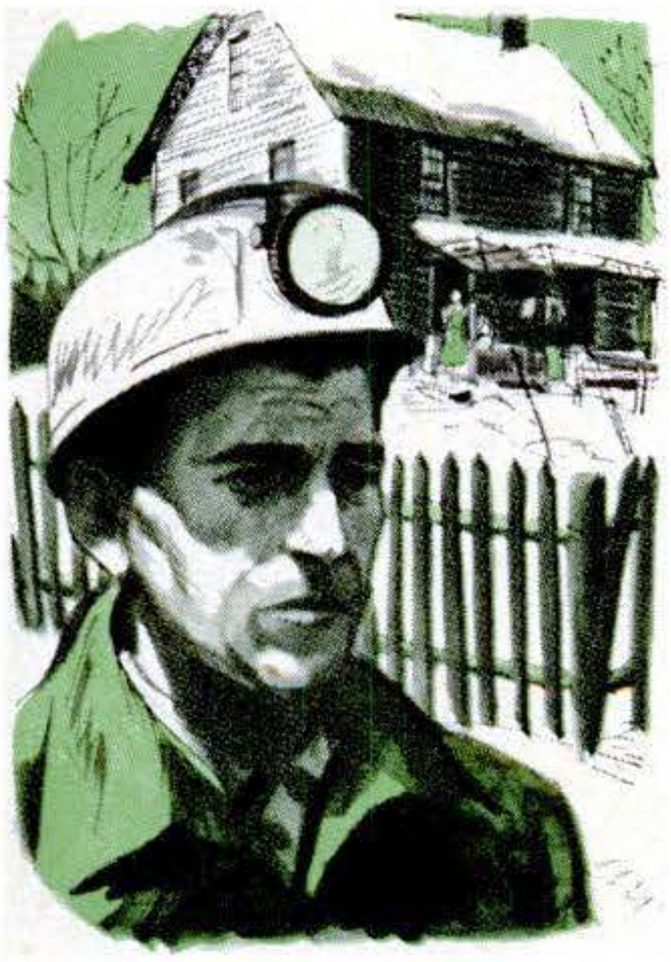
Hero's Medal Honors Miner Who Saved Pal

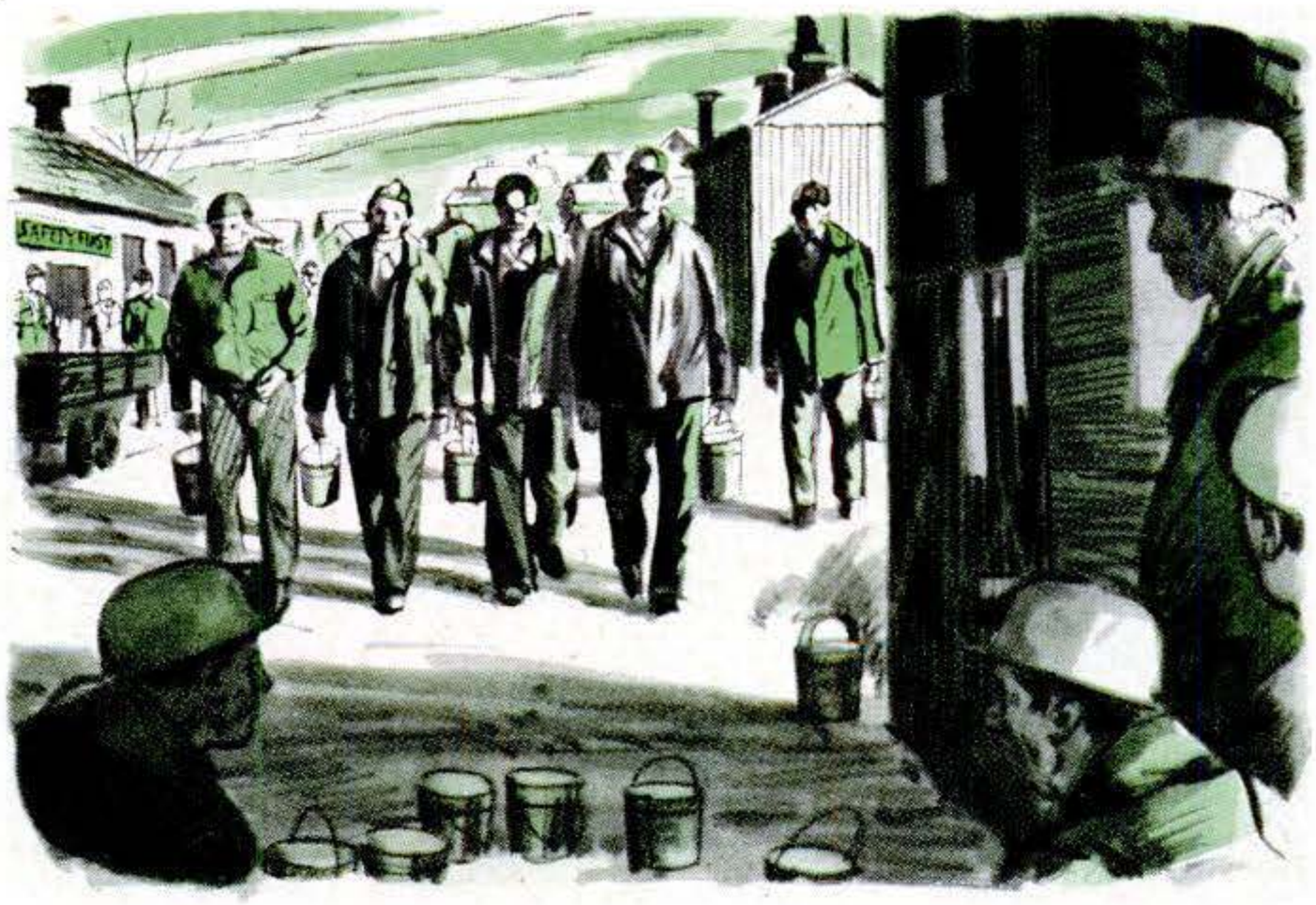
His bravery cheated death as explosion blasted their underground coal room

HIS companion was unconscious when Dwight Knupp came to in the black, smoke-filled, fume-choked pit 450 feet underground. What happened is shown in these sketches of the drama that earned the 33-year-old coal miner a 1953 Medal of Honor of the Holmes Safety Association.

1 THE TIPPLE of the Acosta-Gray No. 3 Mine, the scene of the drama, towers skyward on the fringe of the little mine patch of Gray, Pa. The town got its name from the fact that at one time the houses, then company-owned, were all painted gray.

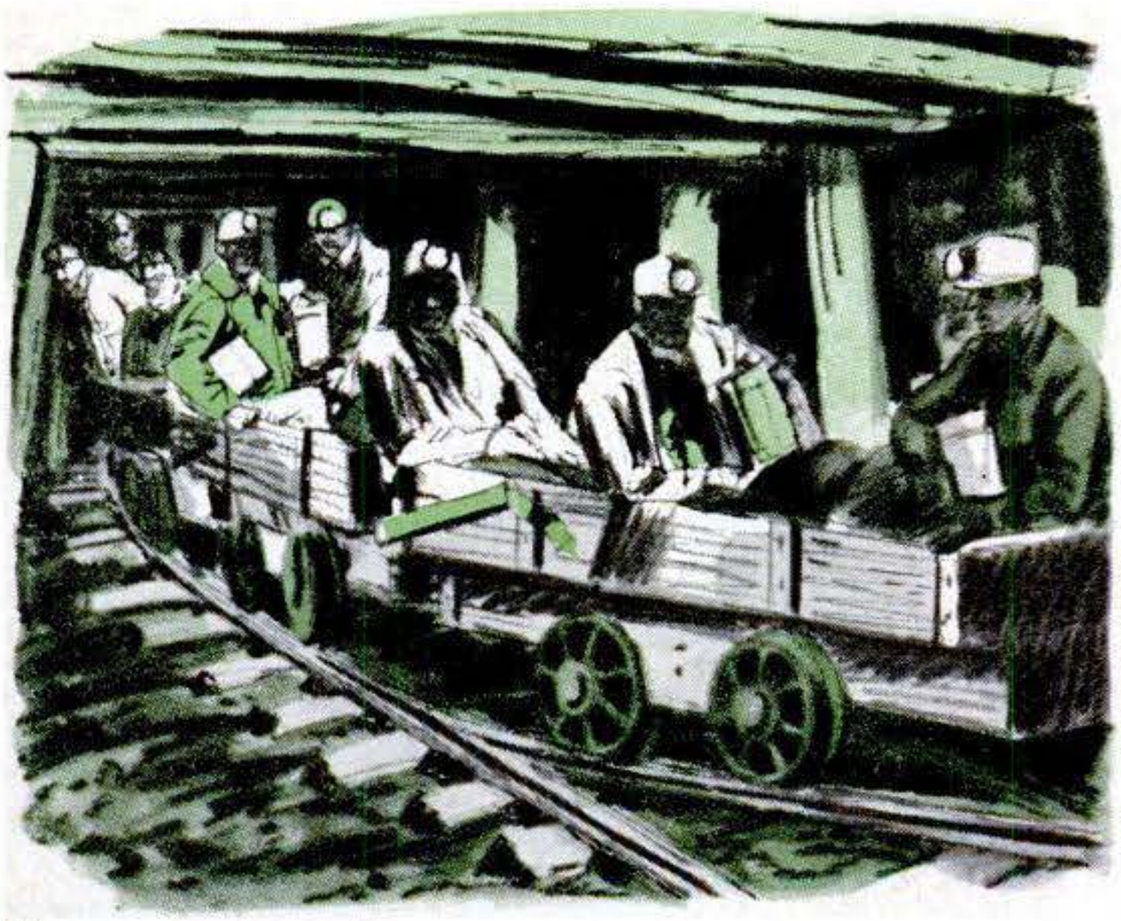


2 DWIGHT KNUPP leaves his home near Boswell, Pa., early Monday morning, March 24, 1952. He mines coal to support a wife, and nine children ranging from two to 13.



3 THE DAY SHIFT converges on the tipple, lunch pails in hand. Knupp, far right, hurries to catch up with Lawrence Geisbert, also cast for a key role in the day's disaster.

4 AT THE BOTTOM of the 300-foot mine shaft, the two men hop aboard one of a string of cars called "mantrips" when hauling men.



5 AT THE END of a two-mile trip they are 450 feet underground. Now they crawl several hundred feet to reach their work location.

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6 HEADWAY in the workroom is only 36 inches. Knupp starts to shovel coal as Geisbert turns on electric mining machine.

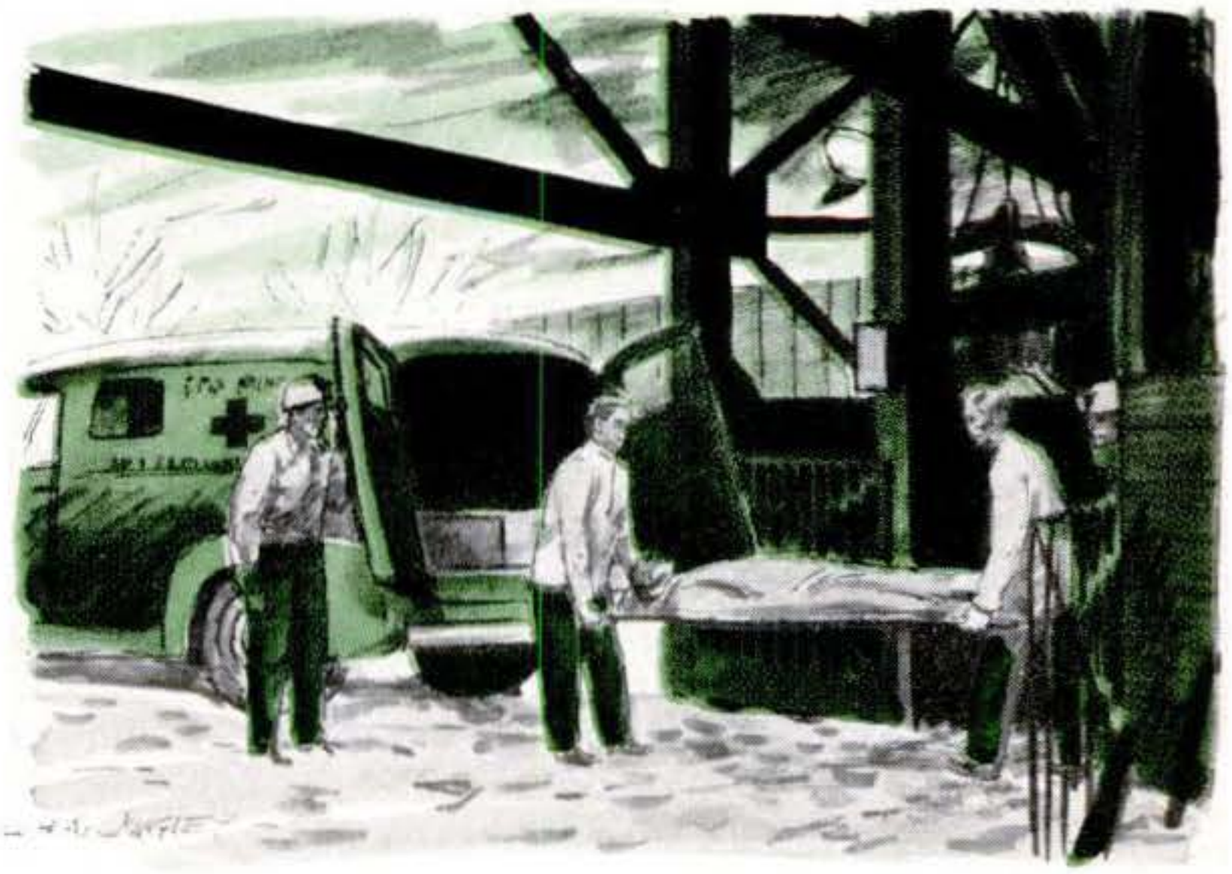
7 EXPLOSION of methane gas is set off by a spark. Both men are knocked unconscious. Smoke and fumes fill the room.

8 FIRST TO RECOVER is Knupp. Although badly burned and bruised, he gropes around and finds his companion. Geisbert, more seriously injured, is unable to move.

9 KNUPP, realizing that they can't live long amid the fumes, lifts Geisbert. Tugging, dragging, he gets his much heavier friend onto a conveyor and starts the controls.

10 AT WORKROOM HEADING, other miners load the two injured men on a mantrip and push them to the mineshaft elevator.

11 AMBULANCE RIDE to hospital is last lap. Mine experts say Geisbert would not have lived 10 minutes in explosion room.



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Plastic Lifeline Can't Sink

MADE of lighter-than-water polyethelene, a new type of heaving line is taking the place of vegetable-fiber ropes as lifeboat equipment. Because it is nonabsorbent it will float indefinitely. It is extremely elastic, and its glass-like sheen makes it easy to see, as shown in the Esso Oilways photo at right. American Manufacturing Co., which makes one-inch Floaterope, believes that larger sizes may become popular as light towing lines.

Mighty Mite Dons Water Wings

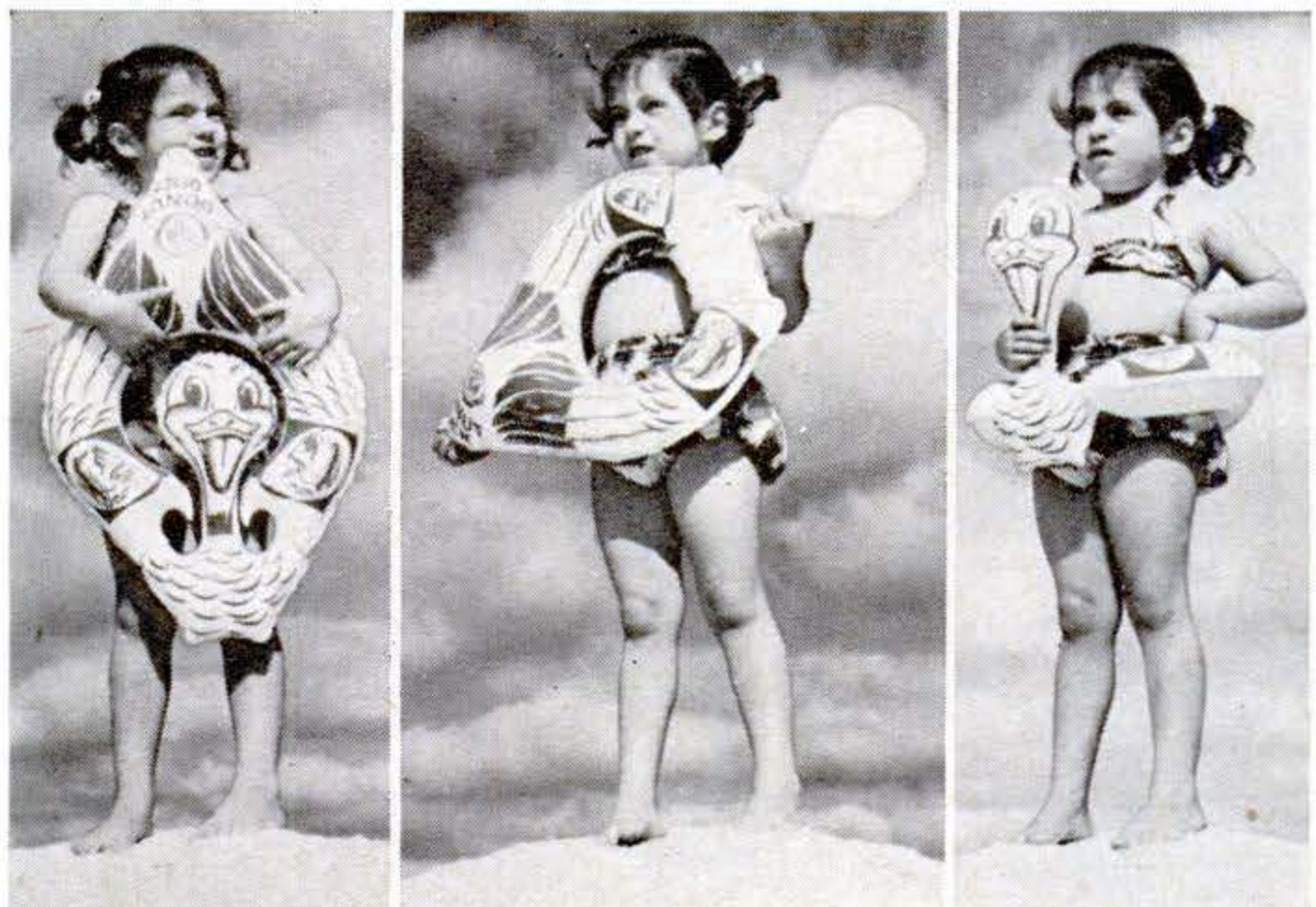
THE Marine Corps' Mighty Mite has added swimming to its land and airlift feats (PSM, June '53, p. 88).

Flotation gear consists of four rubber tubes which can be attached to the car and inflated from the engine's exhaust. Churning wheels propel and steer the Mighty Mite, which has a top cruising speed of a little more than two miles an hour.

Float Ring for Young Bathers Has Retractable Head Grip

EASY to store and simple to inflate, a new vinylite plastic swim ring has a head section recessed at its center which inflates with the rest of the ring and is then passed through it to form a handhold for young navigators.

Repeated flexing of the plastic causes no cracks or tears, and the soft surface resists salt water and wear by gritty sand. Donut Duck can be purchased for $1 at department and specialty stores.



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Big-Scale Designs for A-Power Revealed

From industry's drawing boards come bold new ways for mighty electric generating stations to harness the atom.

By Alden P. Armagnac

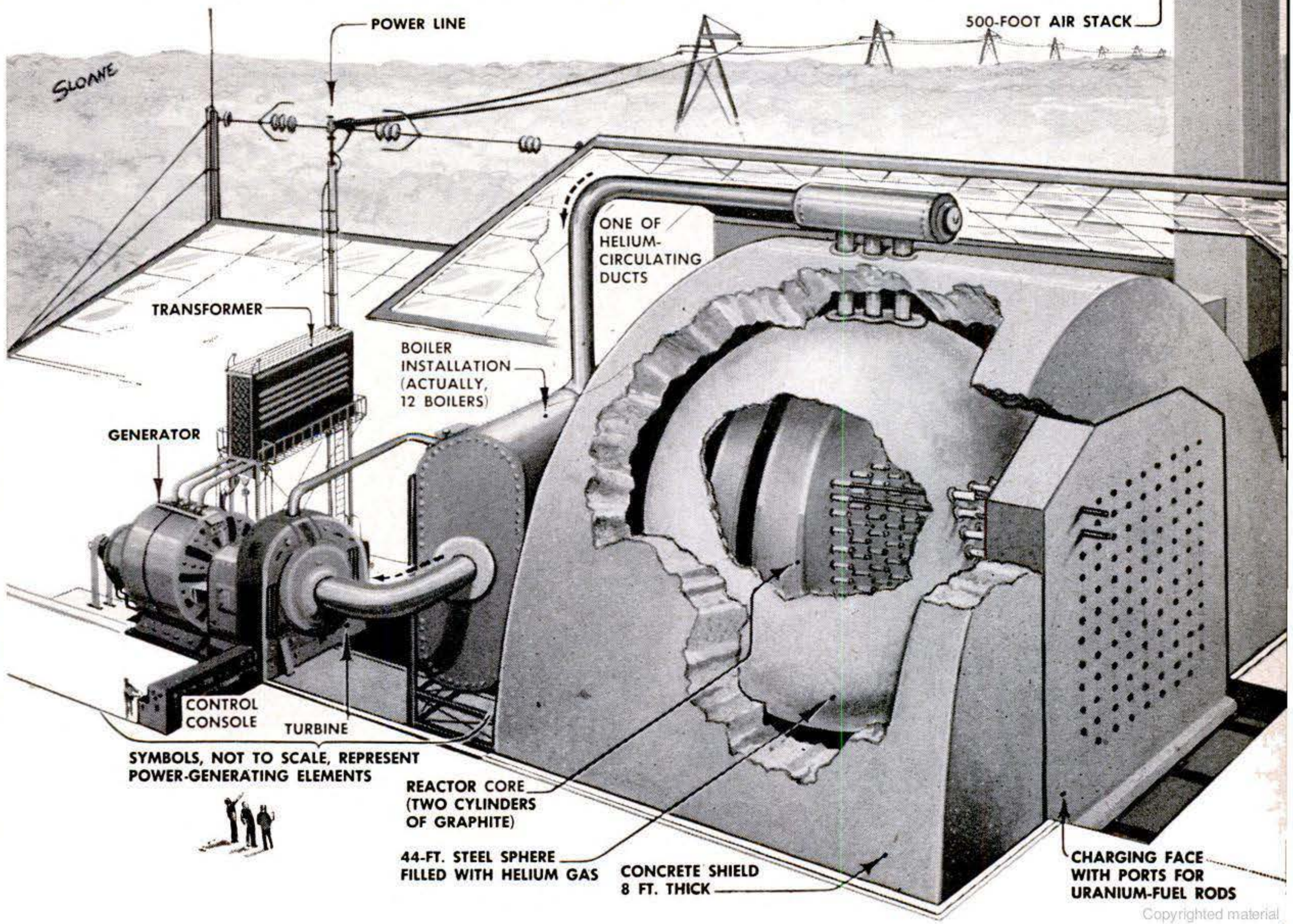
WANT a preview of the atomic-power station that may light your home some day?

A scale model demonstrates a pilot-size plant that can be built right now for $10,000,000. So says North American Aviation, Inc., which designed it for the U. S. Atomic Energy Commission. Heat from a uranium-fueled atomic furnace, conveyed by liquid metal to an underground boiler room, makes steam to run a turbogenerator yielding 8,000 kilowatts—enough for 2,000 average homes.

Meanwhile engineers of leading U. S. electric and chemical companies, aided by the AEC, have been working since 1951 on designs for really big-scale future A-power plants. A recent AEC report reveals what's cooking.

Arched like a huge air-raid shelter, a concrete shield surrounds a 44-foot

Massive shield of a new atom-power design encloses reactor in 44-foot steel globe.



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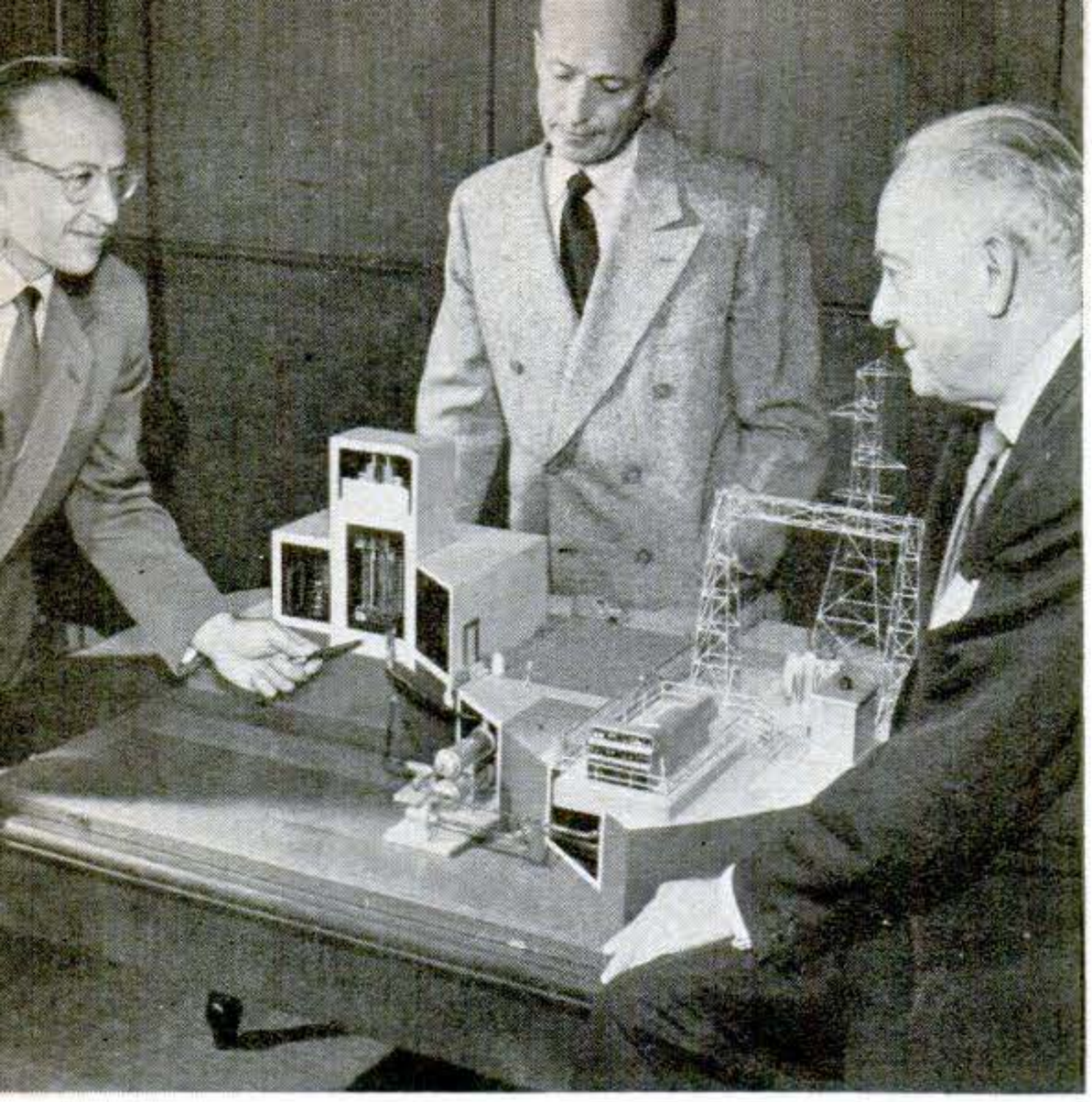
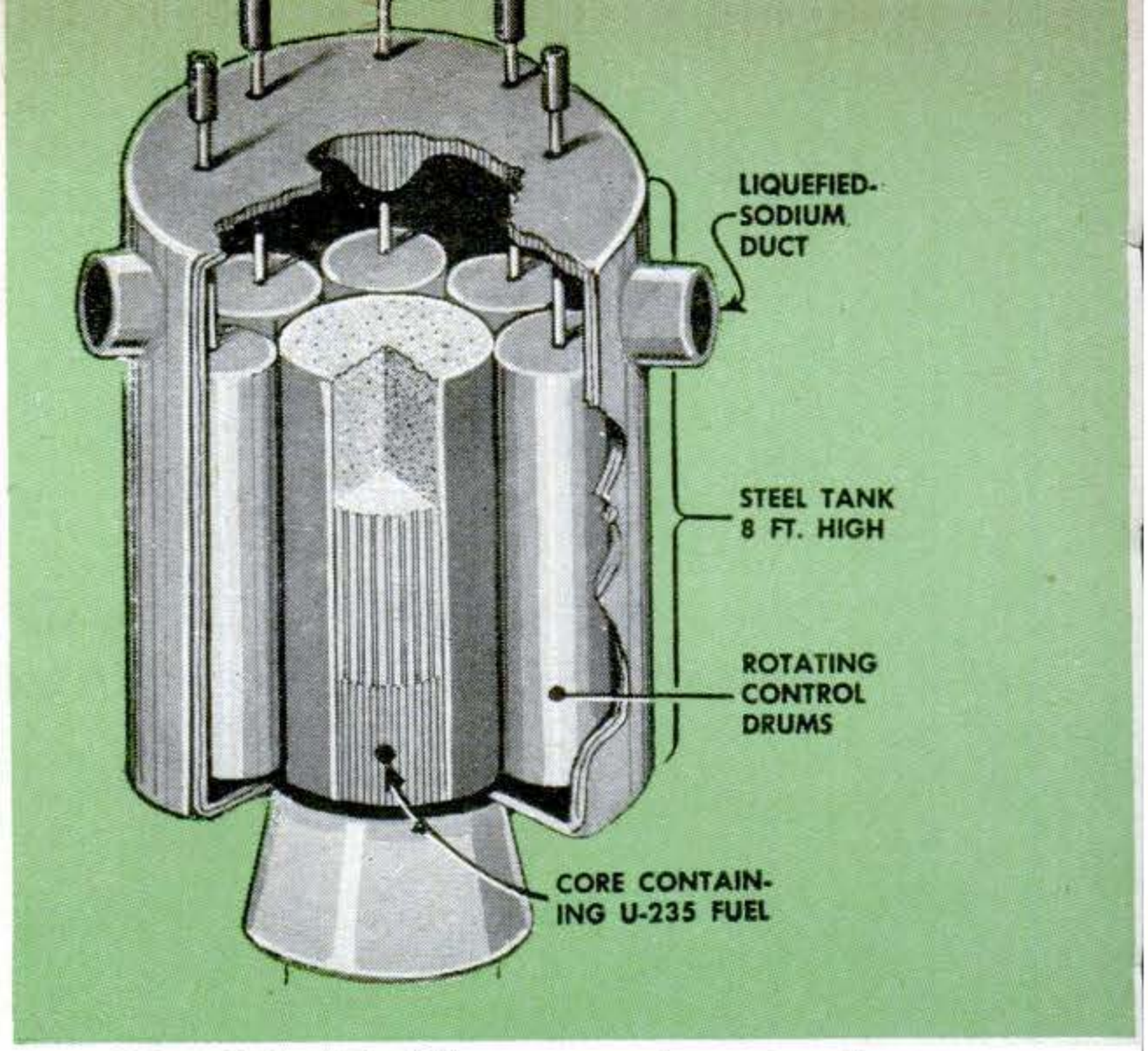
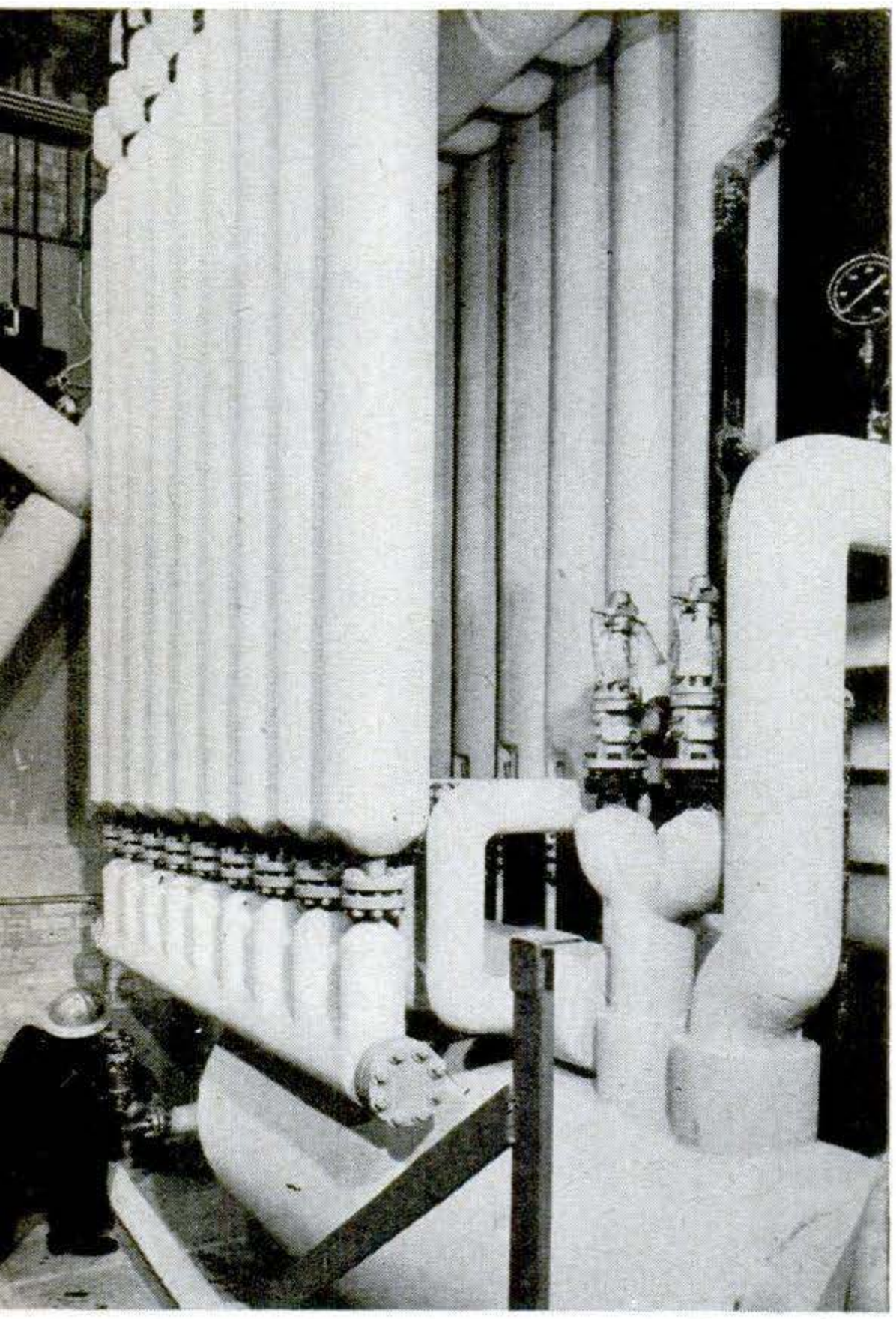


SMALLEST OF DESIGNS, 8,000-kilowatt pilot plant, is no pygmy. Reactor compares in heat output with Brookhaven pile, most powerful for which figures are public.



A MIGHTY MIDGET, this proposed reactor has core only 38 inches high, but could spin turbine generating 154,000 kilowatts. It burns concentrated U-235, has novel controls.



PIONEER ATOMIC-POWER BOILER, designed at Argonne National Laboratory, now harnesses Experimental Breeder Reactor at Arco, Idaho. Liquid metal heats it to make steam.

steel globe containing a graphite-uranium reactor, in a design by a Commonwealth Edison Co.-Public Service Co. of Northern Illinois engineering team. A 500-foot-high stack, venting heated air from within the shield, causes inward suction that prevents escape of airborne radioactivity into the building. Pressurized helium gas carries the reactor's heat to boilers, whose steam drives a 60,000-kw. turbogenerator. Net power, after deducting what the plant itself consumes, amounts to 46,000 kilowatts. This plant would cost $40,000,000.

Another design by the same team proposes a heavy water-uranium reactor in a 20-foot globe. The heavy water carries heat to boilers for steam-making. This plant has three 80,000-kw. turbogenerators and a net output of 211,500 kilowatts. It could be built for $118,000,000.

An octagonal graphite-and-enriched-uranium reactor, nearly 90 feet in maximum diameter and 30 feet high, is envisioned in a Monsanto Chemical Co.-Union Electric Co. design. Liquid metal, a sodium alloy of low melting point, transfers heat. Three or more turbogenerators deliver up to 554,000 kilowatts net. It would cost $61,000,000.

A midget reactor in a steel cylinder

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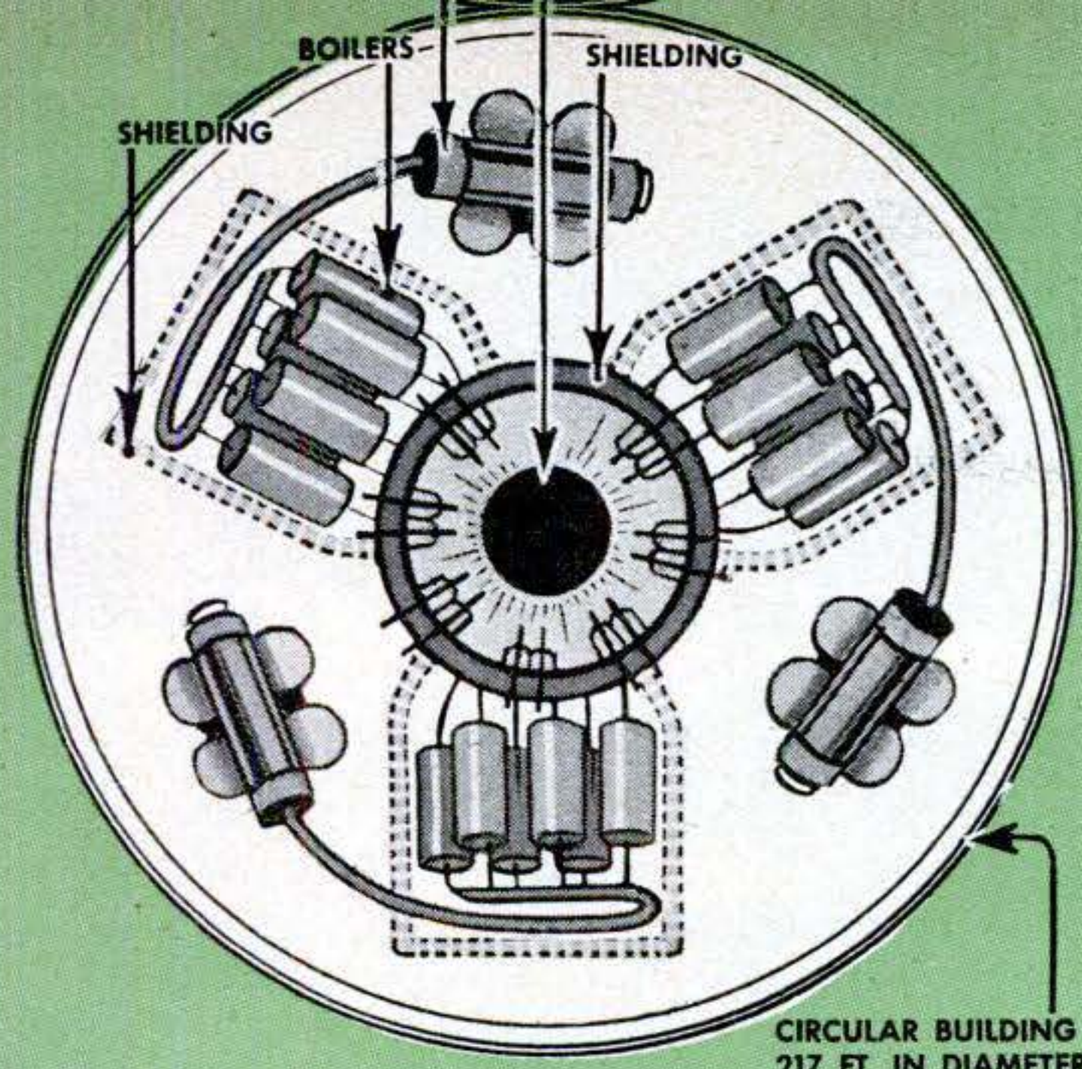


CIRCULAR ATOMIC-POWER PLANT, with boilers and turbines grouped around reactor in 20-foot globe, is one of big-scale designs on drawing boards of U. S. power companies.

only eight feet tall and wide spins a great 154,000-kw. turbine, in a Pacific Gas & Electric Co.-Bechtel Corp. design, and yields 145,000 kilowatts net. This souped-up or "fast" reactor burns highly concentrated fuel—fissionable uranium-235—in a cylindrical core 38 inches high and broad.

Surrounding drums, a novel means of control, may be rotated. To fan the nuclear fire, they bring neutron-reflecting material near it. To check it, they present a neutron-absorbing blanket of uranium, whose U-235 content has been removed or spent as fuel. Then the reactor, acting as a "breeder," makes new fuel by turning the depleted uranium into fissionable plutonium. Liquefied sodium collects heat for the power plant. This attractive little number has a $51,000,000 price tag.

Molten fuel feeds a uranium-235 reactor in a power plant of up to 138,000 kilowatts, so radical in atomic engineering that final design and cost are still to be worked out by its Dow Chemical Co.-Detroit Edison Co. sponsors. A tremendous advantage of its fluid fuel would be the ease of reconditioning it for re-use.

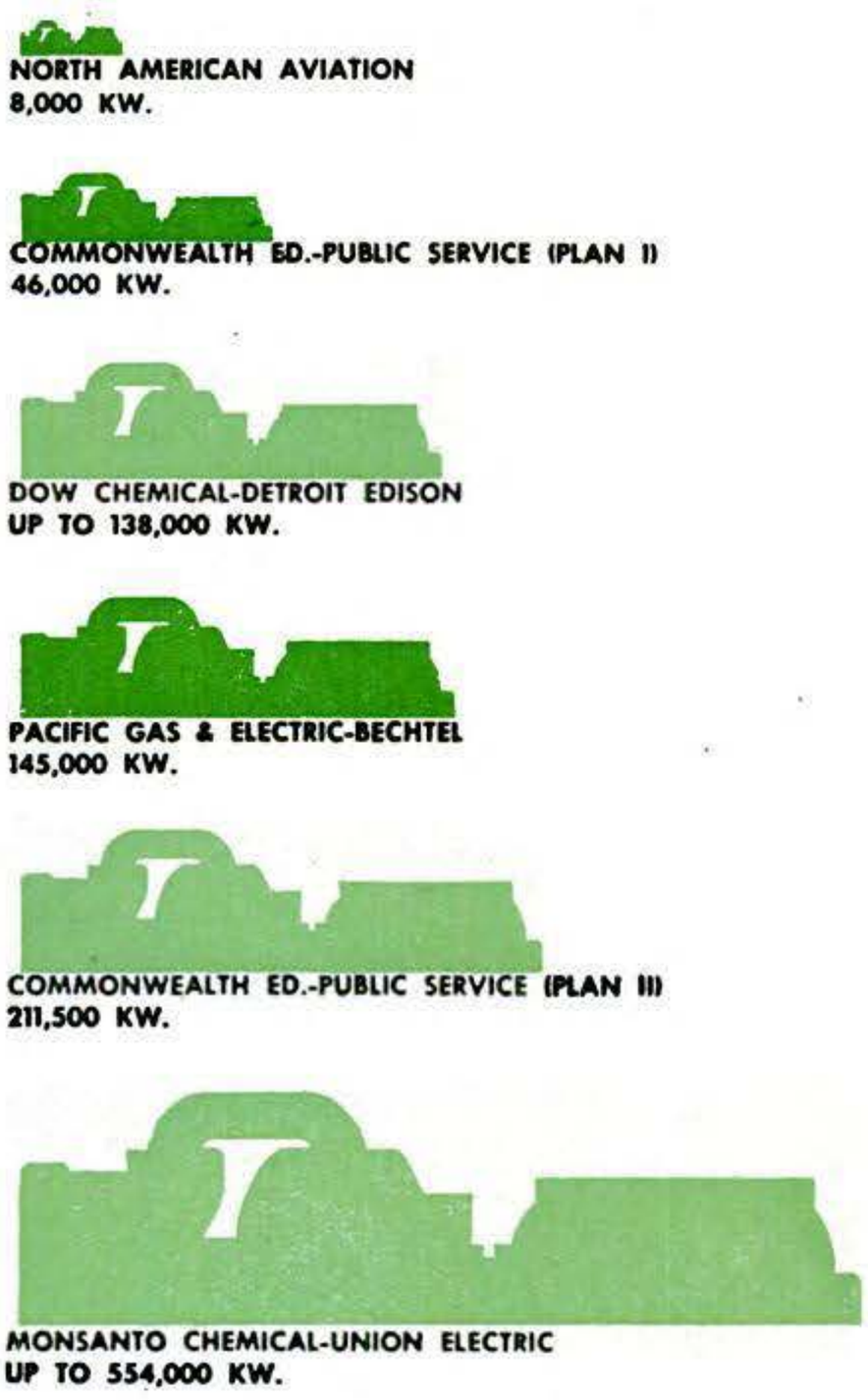
Ultimate objective is a reactor whose core is a potful of molten fuel, almost at red heat. Possibilities for the fusible fuel include a uranium alloy, a uranium salt, or solid fuel particles suspended in a metal of lower melting point. Matching one with reactor materials that can withstand its heat is no small problem. So a modified, more immediately realizable design would be developed first. Uranium-alloy fuel flows in and out in the molten state, but solidifies briefly in the core, easing heat-resisting problems there.

This mobile-fuel reactor would be of the breeder type. Its intense heat would raise liquid metal to 1,020°F., for making steam and power with high efficiency.

This veritable atomic blowtorch would undergo first trials on a lake ship or barge, moored or sunk well offshore to safeguard a locality's inhabitants.

A cool million dollars already backs the promise of this forward-looking design. The Dow-Detroit Edison group has put up $275,000 to develop it, and AEC laboratories are expending $725,000 in supporting research. END

Comparative Size of Atomic-Power Plants



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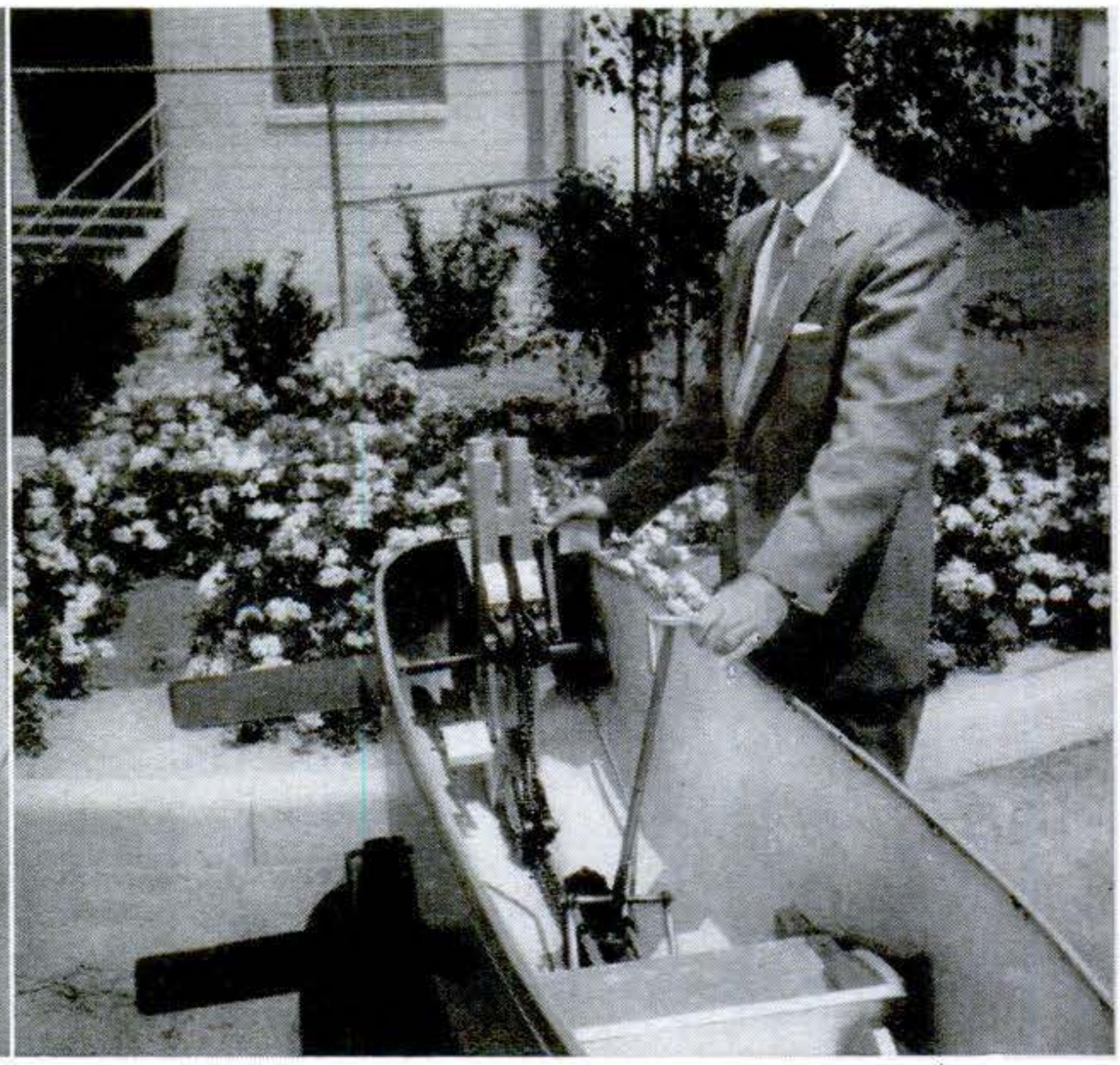
Ocean Diver Rides Pedal-Powered Sub

Buoyant enough to stay at the surface, one-man submarine is shown ready for an ocean dive.

WEARING DIVING LUNG and face mask, pilot sits in a plastic-covered cockpit that fills with water when the minisub is launched. He can remain submerged for an hour.



CANOPY has been removed to show working parts of "bathtub" submarine. Co-inventor Gongwer has left hand on control stick. Up front are foot pedals and chain-drive.

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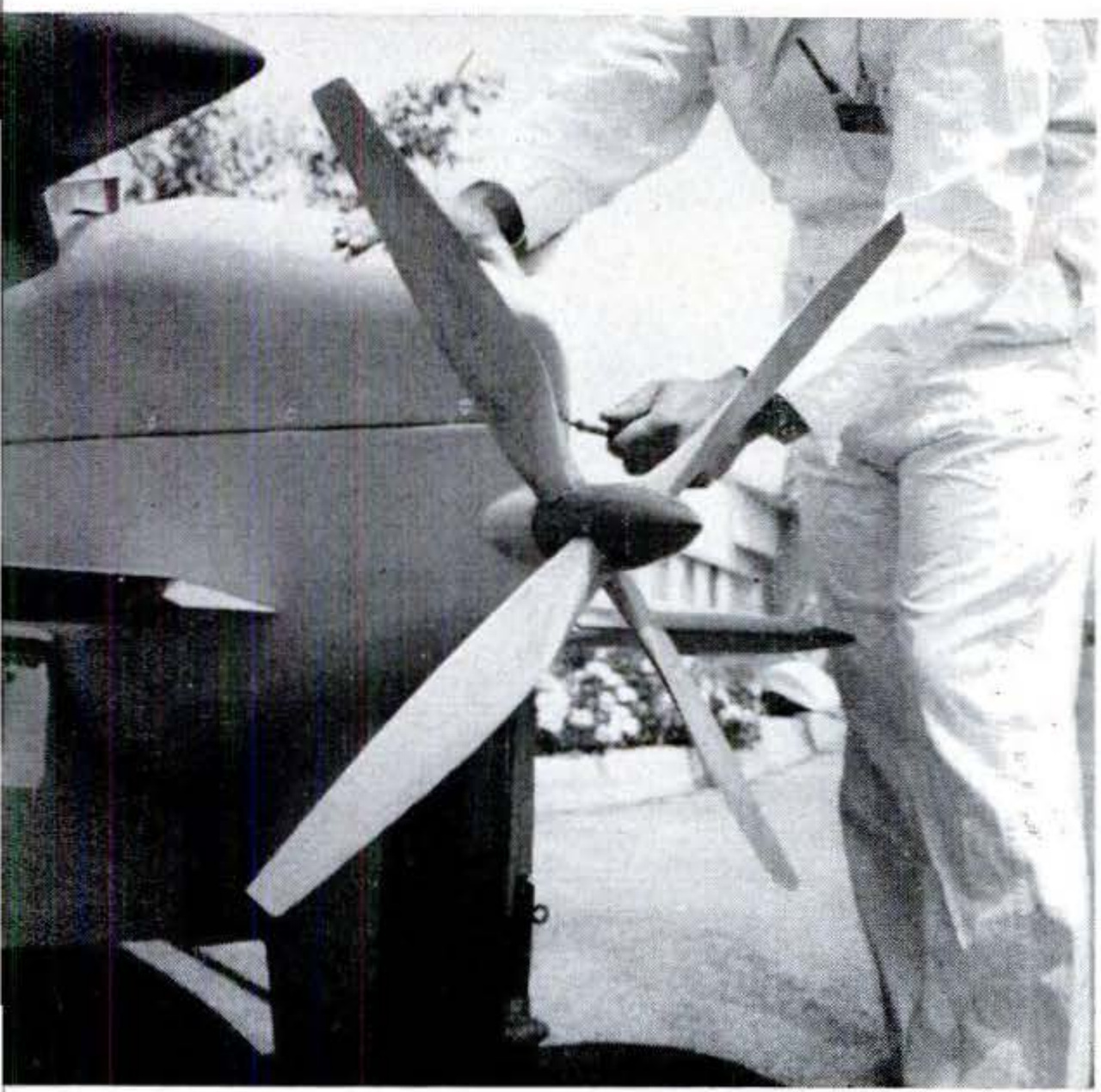
JULES VERNE, with all his imagination, never dreamed of taking a bathtub to sea as a submarine. But that is just about what two young California engineers have done with their unique, one-man, leg-powered "minisub."

The 145-pound, eight-and-a-half-foot-long craft is made of glass fibers and has a plastic cockpit bubble over the skipper's seat. Since the minisub, when launched, sinks and fills with water, leaving only the bubble above the surface, the pilot wears a compressed-air diving lung and face mask (July, p. 160). Bicycle pedals chain-power small, aircraft-type propellers, and a single control stick operates fore and aft fin surfaces for diving and underwater maneuvers, including loops.

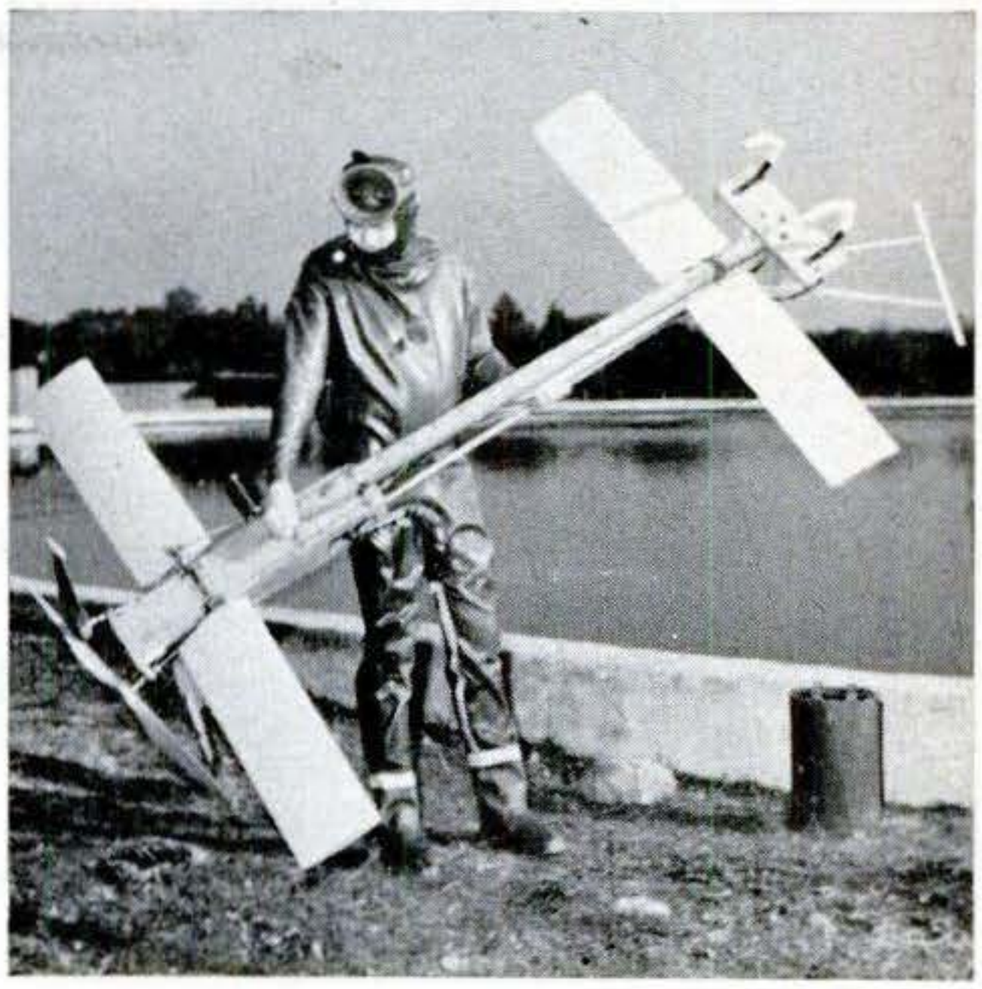
The little sub's builders, C. A. Gongwer and G. M. McRoberts of the Aerojet General Corp., claim that it slips through the water with one-third less resistance than a man swimming. Speed, they say, is about four miles an hour. They expect to up that by installing a battery-operated electric motor. Then they hope to put the minisub on the market for about $1,500.

If you are economy-minded but still want to explore the ocean bottom at ease, the two inventors have an underwater bike. It's not so fancy, but better than swimming.

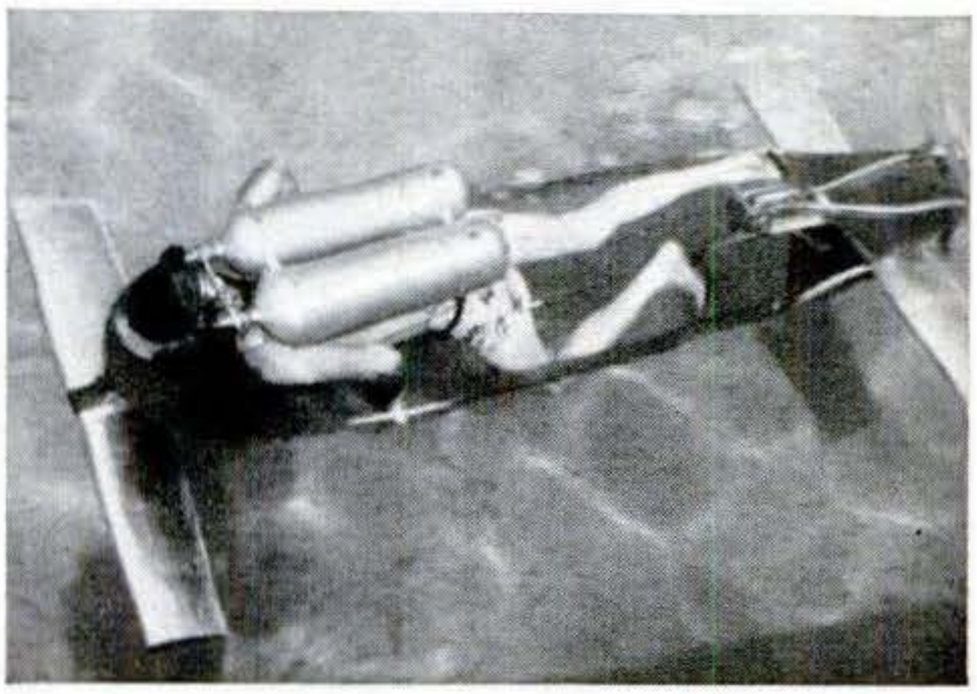


ALUMINUM PROP BLADES rotate in opposite directions to counteract torque. With installation of half-horsepower electric motor, inventors say tiny sub will do eight m.p.h.

From These Trial Jobs Came the One-Man Sub



IN THIS EARLY MODEL, operator stretched out prone on stick and rested shoulders in curved metal pieces seen at upper right.



FLAT BOARD has now replaced slender stick. Control fins are aluminum instead of wood; air tanks have been added.

CANOPY gives streamlining and submarine look, but operator still lies flat in this version. It had a similar bottom fairing.

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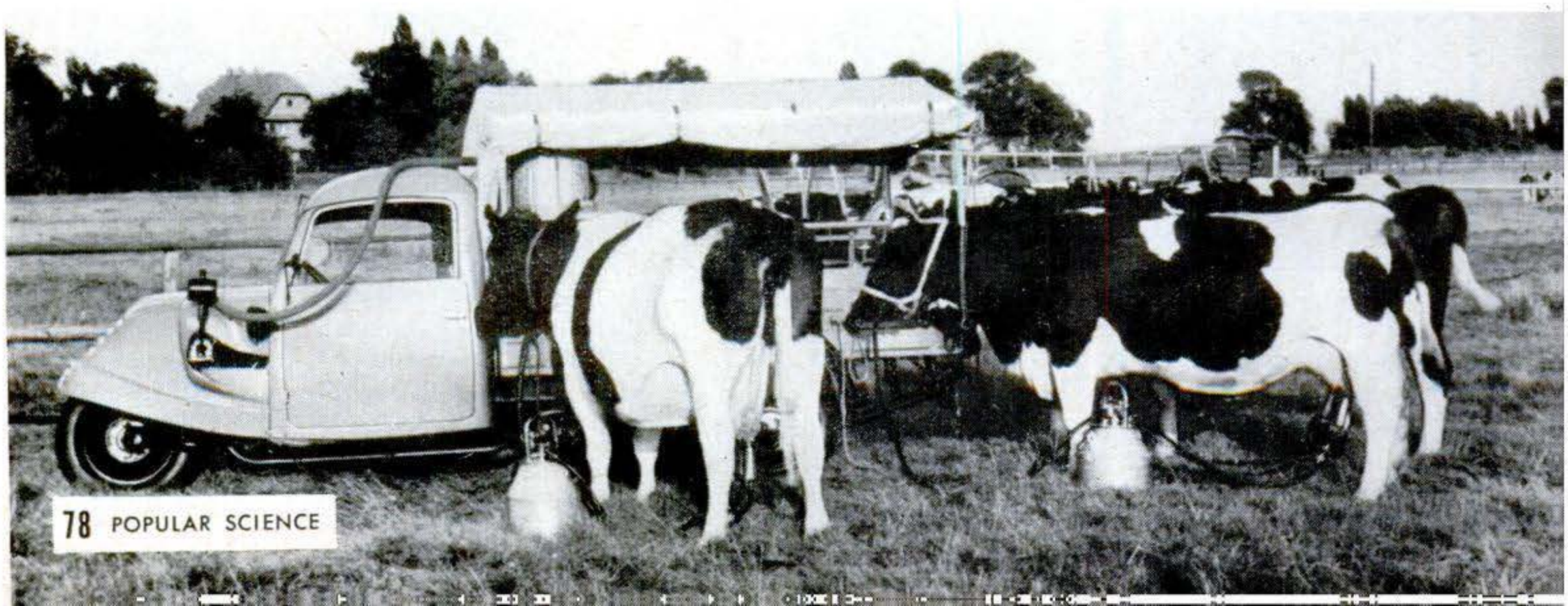
Automobile's Instrument Panel Looks Like Spaceship's

JOE BAILON'S '41 Chevrolet has enough dials (15 of them) and push buttons (32) to run a spaceship. Tools for road repairs are cached in the door panels and the tailpipes are recessed in the rear bumper.

A Haywood, Calif., car enthusiast, Bailon paid $50 for the car as a wreck five years ago, then put in thousands improving it. To date, he has walked off with 19 cups in custom competition.

German Truck Turns Into a Portable Milking Machine . . .

INSTEAD of driving the cows to the milking machine, why not drive the milking machine to the cows? You can do just that with this three-wheeled truck, made by the Goliath Works in Germany. A vacuum pump is driven by the engine to power eight milking machines. With the milkers removed, the car can be used for other jobs.



Police Call In Via Radiophone

A HANDIE-TALKIE in this call box gives police more scope. In an emergency, it can be lifted out and run on batteries to keep a roving patrolman in constant touch with the station. Motorola designed the system.

How to Get Fed by Infrared

THIS gal is frying an egg over a 1,550-watt infrared lamp. The gold-lined, tough glass bulb won't break even if ice water is poured on its hot surface. Sylvania makes the bulb; Sears, Roebuck sells the stove.

. . . And a Farm Truck Becomes a Rolling Service Station

ALEX METZLER, a California farmer who works 5,000 acres, decided to do something about the time wasted driving equipment back to the barn for servicing. His portable service station is shown below greasing a tractor. Large tanks on the Ford dispense gas, diesel oil and water. Small ones hold air, motor oil, grease and brake fluid.

The Toughest Peaks Are Still Untouched

Everest is climbed—but the cloud-capped summits of giants yet unconquered still challenge the adventurous mountaineer.

By Gardner Soule

"THERE is no end," said George Leigh-Mallory, "to this kingdom of adventure."

When he said it, Mallory, a great British mountaineer, had a chance to climb Mount Everest, and what he meant was that reaching the summit would in no sense end the tasks ahead of explorers.

Mallory himself in 1924 climbed closer to Everest's peak than anyone before him. He was last seen heading upward with a companion when a cloud closed down and blotted out his fate forever.

To this day no one knows whether Mallory and his teammate, Andy Irvine, did climb Everest. But in May 1953, two other men—a beekeeper named Edmond P. Hillary, from New Zealand, and a Nepalese named Tensing Norkay, reached the summit of the highest mountain.

And their achievement, great as the world acknowledges it to be, by no means ends what Mallory called the "kingdom of adventure."

Instead, ahead of mountaineers and explorers—today's climber is usually a combination of both—lie such glittering goals as they never have had before. This is partly because constant exploration locates new mountains, partly be-

TOUGHER THAN EVEREST, many mountaineers have judged, is K-2, world's second tallest peak at 28,250 feet. It's in the Karakorams, Kashmir. Summit pyramid is continuous rock-and-ice climb for two and a half miles. U.S. team under Dr. Charles Houston is trying it (PSM, July, Page 70).

THIRD BIGGEST after Everest and K-2 is Kanchenjunga (28,166 feet), 45 miles from Darjeeling, India. Climbers have struggled for days to cross its long ice ridge, sleeping in ice caves. They have even tunneled through some barriers. But storms and avalanches that hurl down icebergs have kept it unclimbed.

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cause new methods like ski-equipped airplanes bring inaccessible places into reach, partly because the feats of men like Hillary and Tensing spur on others.

The barest handful of the world's unclimbed peaks are shown in the photos.

Mountaineers avoid comparisons, yet it looks as if many of these and some other summits will offer difficulties even greater than did Mount Everest. Men since 1922 have thought they knew a way to the summit of Everest. Many mountains even today have revealed no path to their peaks.

Still others, all over the world, are in areas so rugged they are not even approached. An example of one such mountain was Annapurna, climbed in 1951 by France's Maurice Herzog. Herzog and his party were the first white men to get within 50 miles of Annapurna, in Nepal.

The other day in New York City,

UNATTEMPTED **Paiju, in Pakistan's Karakoram range, frightening and impossible as it looks, is nevertheless only average in difficulty for the Karakorams. "I doubt it'll ever be climbed," says Wood. Photo will give you an idea of appearance of a mountain so discouraging that mountaineers don't even attempt it.**

NAKED MOUNTAIN **Nanga Parbat, north of Kashmir, is most murderous of all. 31 men died in first four attempts on summit. In 1937, last attempt before one currently being made by Germans, an ice avalanche buried 16 men.** ***(Editor's note: Nanga Parbat was conquered by German expedition on July 4!)***

THIN AIR atop unclimbed 27,890-foot Lhotse (right), world's fourth highest peak, may be attempted by mountaineers. Photo was made on 1950 U.S. expedition that opened route used by British this year to climb Everest (center).

STORM STOPPERS "Mount Cook" (center), says Wood, "has not been climbed. It's on the Alaska-Canada border. You can see one reason in photo: those clouds. They're a storm coming from the Pacific."

ARCTIC ICEBOX "Here," said Walter Wood, "take your pick. You are looking across the Upper Seward Glacier, northwest Canada. None of these has been climbed." Permanent snow and ice are chief hazards on arctic climbs.

Walter A. Wood, one of the United States' outstanding climbers, summed up the situation:

"What's *left* for the mountaineer? What's *gone*, you mean," he said. "After all, what peaks have been climbed? Only a little of the highest cream has been skimmed off."

Wood himself has more first ascents to his credit than most climbers, in the arctic and sub-arctic of Alaska and Canada. He was first up Mounts Steele, Wood, Walsh, Hubbard, Alverstone. The heights of these range from 14,500 (Alverstone) to 16,439 feet (Steele).

"After all," he said, "the only ranges where you will find more peaks climbed than unclimbed are in Europe, New Zealand, and the western U. S.

"What remains now is most all of the mountains in most all of the world's great ranges. Even if every expedition in the field this year is successful, this would still be overwhelmingly true. Most high mountains are untouched.

"Mountaineers have work to do from the bottom of the earth up. The antarctic is studded with mountains. With the exception of a few close to the sea, none has been climbed.

"In Africa—in the Ruwenzori and Kenya ranges and others—many summits are unreached.

"Farther north still, I don't remember any reports that any of the Kamchatkas in eastern Siberia have been climbed.

"I could go on all day," he said.

He did go on long enough to mention all the places shown in the photographs.

"The climbing of Mount Everest," Wood said, "is in no sense any kind of end to mountaineering. It's the beginning." END

QUESTION MARKS Uncertain as to difficulties they will present are mountains of New Zealand's Takahe Valley, whose frozen lake and "snow grass" are shown in mid-winter (August). The area has just been opened to climbers.

RAIN—5 DAYS OF 7 "In the southern Andes of South America," says Wood, "only half a dozen peaks have been climbed." Near Straits of Magellan (photo), the Andes rise, full of ice-fields. It rains there 250 days a year.

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'Hot' News

Pillow Pad Cools Harried Sleepers

KEEP a cool head and you'll be cool all over, say physiologists. To help you do just that when you're trying to catch some shut-eye on hot nights, the Chillow (right) was invented. A plastic pad with molded-in channels, it fits under the pillowcase. A tiny electric pump circulates water through the pad and back to the pump where it starts its cooling journey all over again. On torrid nights, ice cubes can be added to the water. Jet-Heet, Inc., 152 South Van Brunt St., Englewood, N. J., makes the pad for about $20.

Trunk Reefer Cools Motorists

DEATH VALLEY driving can be as bracing as a spin along the Alaska Highway when you twist the dials of an all-car air conditioner now being offered for 6- and 12-volt electric systems. Developed by Bill Lind, Fort Worth manufacturer, and veteran race driver Babe Stapp, Refrigair (below) consists of a compressor and condenser, mounted under the hood, and a Freon cooler which slides into the trunk.

Air Suit Cools Pilots

THIS flying union suit has a built-in air-conditioning system. Air fed through sewn-in piping cools your skin. The R.A.F. developed the suit, worn under overalls, to save the weight of machinery needed to cool cockpits so pilots don't fry.

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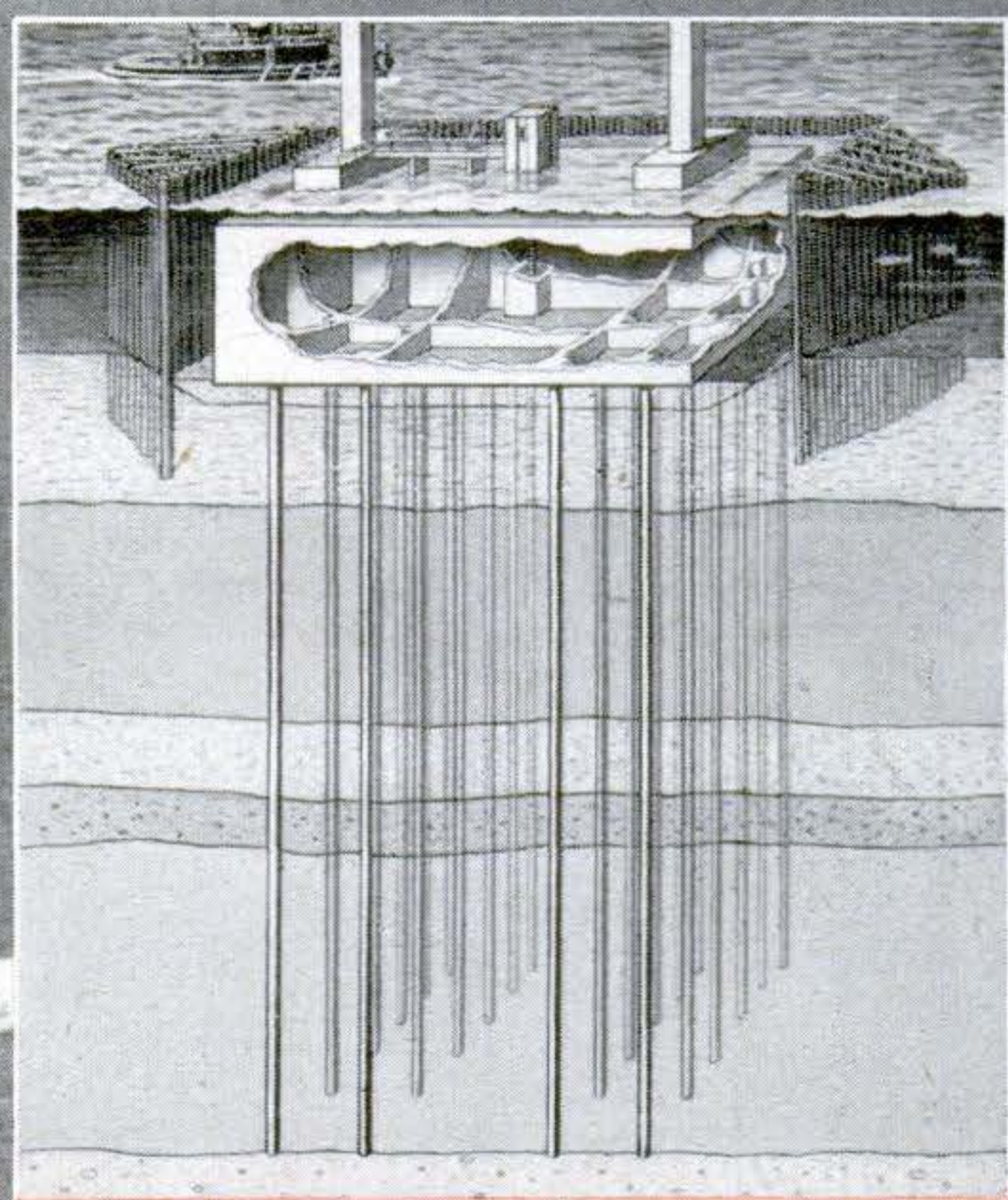

TEN HOLLOW concrete boxes bearing most of weight in section of new bridge will be compartmented. Steel support pins will be three feet thick.

CANTILEVER PART of six-lane road spanning river between Nyack and Tarrytown, N. Y., will be 2,000 feet long; approaches to it are almost two miles long.

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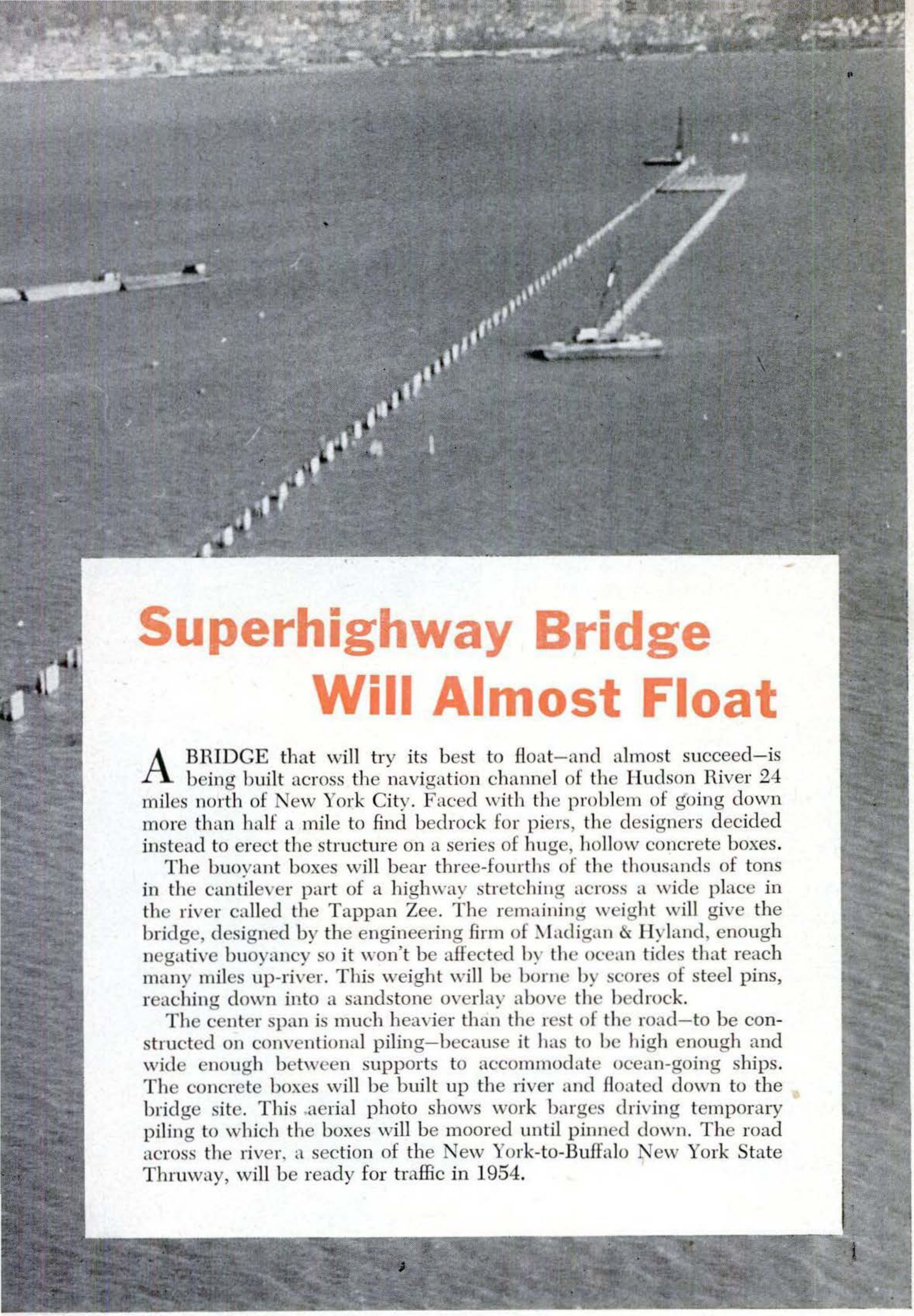

Superhighway Bridge Will Almost Float

A BRIDGE that will try its best to float—and almost succeed—is being built across the navigation channel of the Hudson River 24 miles north of New York City. Faced with the problem of going down more than half a mile to find bedrock for piers, the designers decided instead to erect the structure on a series of huge, hollow concrete boxes.

The buoyant boxes will bear three-fourths of the thousands of tons in the cantilever part of a highway stretching across a wide place in the river called the Tappan Zee. The remaining weight will give the bridge, designed by the engineering firm of Madigan & Hyland, enough negative buoyancy so it won't be affected by the ocean tides that reach many miles up-river. This weight will be borne by scores of steel pins, reaching down into a sandstone overlay above the bedrock.

The center span is much heavier than the rest of the road—to be constructed on conventional piling—because it has to be high enough and wide enough between supports to accommodate ocean-going ships. The concrete boxes will be built up the river and floated down to the bridge site. This aerial photo shows work barges driving temporary piling to which the boxes will be moored until pinned down. The road across the river, a section of the New York-to-Buffalo New York State Thruway, will be ready for traffic in 1954.

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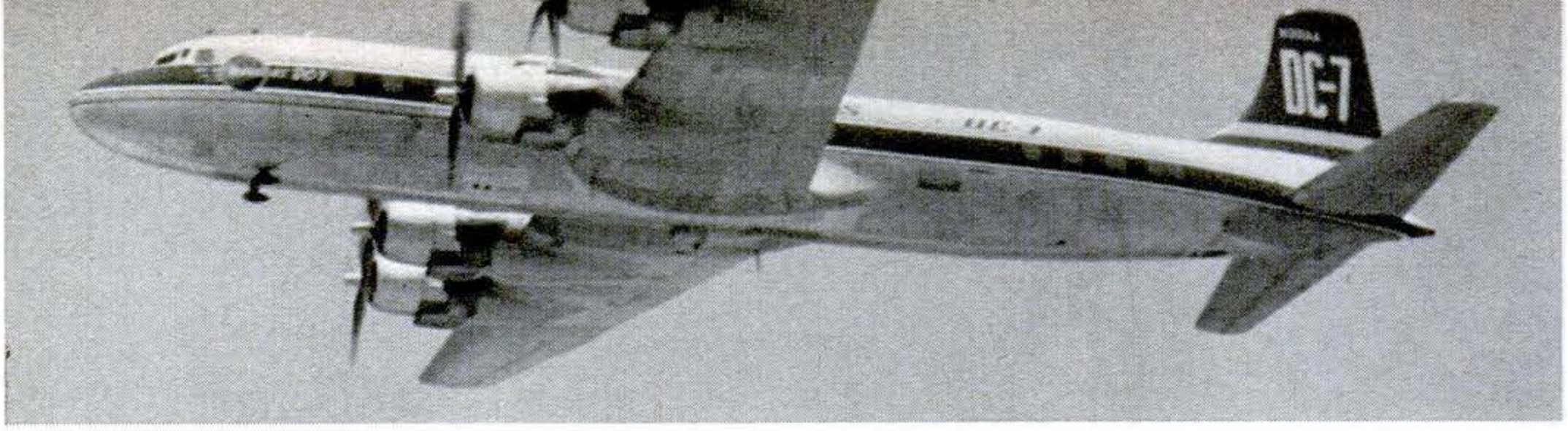


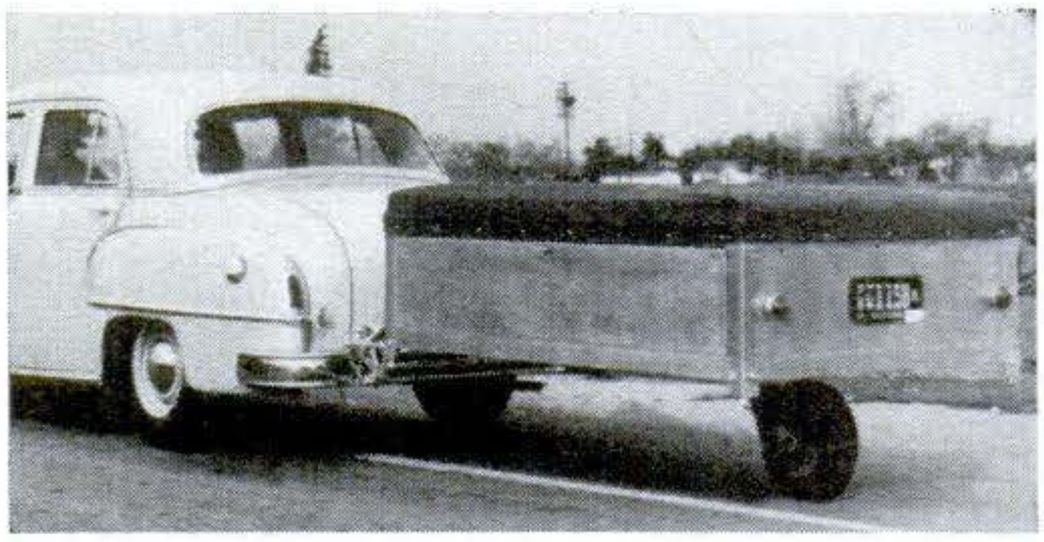
World's Fastest Piston Airliner, DC-7, Flies at 365 M.P.H.

THE Douglas DC-7, capable of toting 96 passengers at 365 miles an hour, will begin flying the major U.S. airline routes this year. It's the world's fastest commercial piston airliner. The cabin is pressurized for sea-level comfort up to 12,500 feet. The new plane can fly a distance of more than 4,400 miles nonstop.

Aluminum Trailer Opens Up into Tent with Double-Sized Bed

ONE minute after the owner of a new kind of trailer-tent spots a place to camp, he can be all set for the night. That's how fast the tent can be put up. It repacks in a minute too.

A lightweight aluminum trailer holds the tent, such camping necessities as skillets and fishing rods, and a bed wide enough for two and long enough for a six-footer. When not used for camping, the trailer will serve as a general haulage cart on the farm or at a summer cabin.



TRAILER PACKS 500-pound load on single wheel. Vehicle's empty weight is 200 pounds. It is made by Heilite Trailers, Lodi, Calif.

OPEN FOR CAMPING, tent is supported by crossbar on two stakes. Canvas floor is integral. Bed has an air mattress. Storage compartment doors open at both sides of trailer.

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A New Magic Bullet Cures an Old Disease

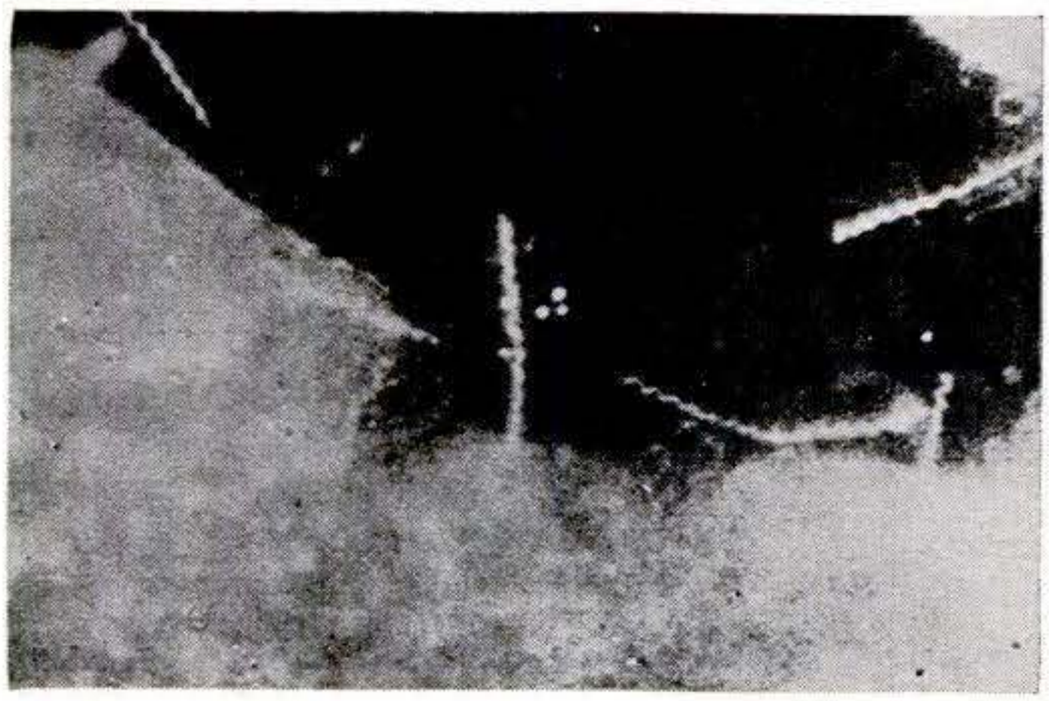
The microscope revealed a swarm of squirming, corkscrew-shaped organisms . . .

One shot of Bicillin, a long-acting form of penicillin, stops syphilis in the early stages, thus simplifying an ancient, difficult war.

By John Pfeiffer

A 20-YEAR-OLD Chicago garage mechanic shifted in his chair while a doctor examined a sample of his blood serum. He wasn't sure about the nature of his infection. But the doctor had no doubts. The microscope revealed a swarm of the squirming, corkscrew-shaped organisms called *Spirochaeta pallida* that cause syphilis.

So, about a sixth of an ounce of milky white fluid, a bit more than a teaspoonful, was injected into his hip muscle. When the youth's blood was examined six hours later, the spirochetes had vanished and they haven't been seen since—after more than 16 months of regular observations.



This story is among the records of Chicago's Municipal Social Hygiene Clinic. Not long ago it would have been dismissed as science fiction of the wildest sort. But the patient's treatment represents a recent and significant development. He was given a new long-acting form of penicillin known as Bicillin (trade name for N, N'-dibenzylethylenediamine dipenicillin G, if you must know). The drug may mark the end of a search which started more than half a century ago for a one-shot "magic bullet" to cure early syphilis.

Preliminary results are encouraging. U.S. Public Health

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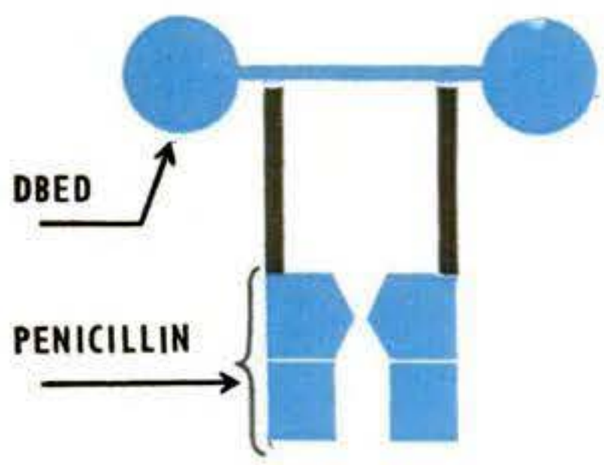
Service experts have been directing a broad experimental program at clinics in Durham, N. C., St. Louis and New Orleans as well as Chicago. They've treated nearly 200 patients. Some 125 early cases have been followed for six months or more, 23 for over a year. And cure rates are about 95 percent!

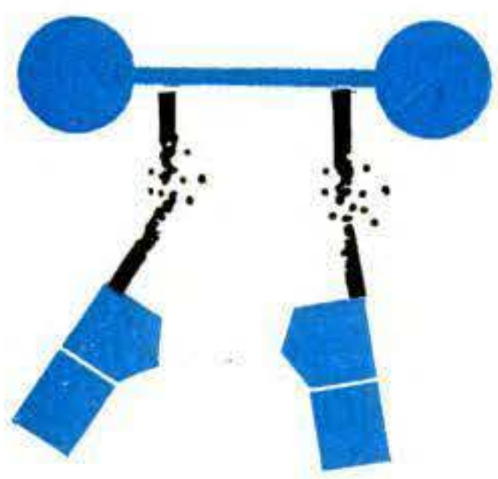
Treatment of syphilis has previously called for a series of injections, and people don't look forward to being stuck with hypodermic needles. (Pills cannot be used, because stomach acids destroy anti-syphilis drugs too quickly.) Furthermore, many patients still do not realize that the untreated disease may lead to fatal heart or brain disease. They start but never finish treatments—and act as dangerous "carriers," spreading the disease to others.

Ten years ago, a single-injection syphilis treatment ranked high on the list of medical daydreams, together with such items as baldness cures, wrinkle-removers, and elixirs of youth.

Bicillin Molecule at Work



Body fluids eat away bonds, slowly releasing penicillin in blood.



Treatment Used to Call for 70 to 80 Shots of "606"

Syphilis spirochetes were properly regarded as tough customers. Their name is Greek for "pale, coiled hair." The microbes not only look like corkscrews; they behave that way. They rear up to their full height (1/3,000 of an inch), spin rapidly, and start boring. Soap and water will easily kill them within an hour, the time they take to penetrate the skin. But special measures are required after the organisms go underground.

For many years doctors prescribed arsenic-containing substances, modified versions of the famous "606" or Salvarsan discovered by Ehrlich back in 1909. Sufferers were supposed to receive 70 to 80 injections, one injection a week, and some schedules called for several hundred shots over a period of three or four years.

The big breakthrough came when penicillin was first used in treating syphilis. The mold extract was safe. It killed spirochetes by the millions, as long as enough of it remained in the blood stream. It was excreted in three hours or so, however, and that meant an average of eight injections a day. A course of treatment usually required up to 80 injections. But at least the ordeal was over in about 10 days instead of 18 months or more.

Doctors then developed ways of prolonging the effects of penicillin and reducing the number of shots. Until recently the best preparation was "PAM"—penicillin in peanut oil combined with aluminum monostearate, a fatty substance allied to fabric-waterproofing agents. There's a familiar theory behind the brewing of this strange concoction. Drink-

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ing a glass of milk is good insurance if you're easily affected by highballs or cocktails. You'll probably have less trouble because alcohol passes slowly into the blood through the milk-fat barrier in your stomach. The fat-oil combination in PAM has a similar effect. It coats the penicillin with a kind of capsule, forming a depot or reservoir in the body. The antibiotic seeps through the capsule fairly slowly and the body receives a steady supply for 72 to 96 hours. Three shots of this preparation administered over a period of eight to 10 days, is a recommended treatment.

Sidewalk tests for syphilis are given behind curtain on busy New York street. Some cases thus discovered will be treated with Bicillin.

Now even this tremendous advance is topped with the coming of Bicillin.

Dr. Joseph Seifert, a tall energetic investigator with a crew-style haircut, is chiefly responsible for the discovery of this new drug. He is head of the biochemical research laboratories of Wyeth Incorporated, a Philadelphia pharmaceutical firm—and doesn't rate as an expert on syphilis. He isn't even interested in the fine points of medical practice; he'd rather talk about the basic workings of the body, or the details of a new drug molecule.

The new anti-syphilis drug is a custom-built molecule. If a Bicillin molecule were magnified a few billion times, you would see a weird-looking structure about the size of a child's bicycle. The main part would have a long, dumbbell shape. Attached to the "bar" of this framework would be two smaller pieces looking something like tiles: a pair of penicillin particles.

The dumbbell part of the molecule—a substance identified by the letters DBED—is a black sheep in an illustrious drug family whose most respected members are standard remedies for hay fever and colds, the antihistamines. By itself, this substance is worthless as a remedy, a fact which Dr. Seifert learned after conducting a series of futile tests more than seven years ago.

The Philadelphia researcher forgot about those tests until a hot August day when he was lunching with a group of colleagues. He was sleepy and wasn't following the conversation too closely. Suddenly he heard something said about DBED forming an extra-strong chemical bond with penicillin. "I sat up and told them this might be the clue to a long-acting penicillin. We started work."

Tests answered a good many questions about DBED.

[Continued on page 230]

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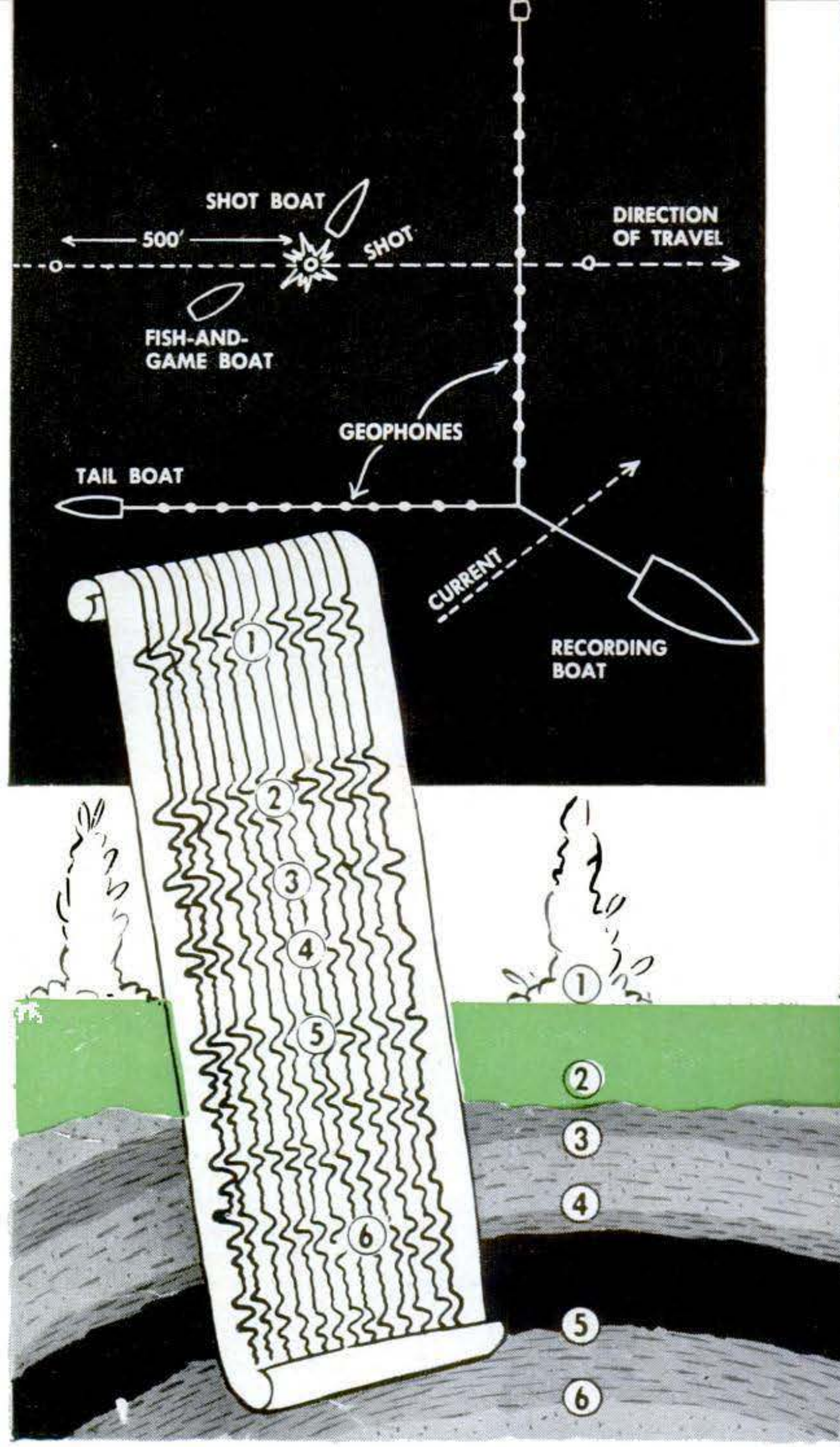
Barber Chair Is Streamlined

RAZOR-WIELDING inventor George Parker claims his new all-upholstered barber chair is the first really new kind in 62 years. That's how long it has taken to break away from pipe-and-casting models. His Pasadena, Calif., clients call his design a "clipper-chair."

Plastic Tubes "Sip" Cups

BLOWN through transparent Tenite tubes, waxed-paper drinking cups make a sanitary trip from forming machines to the shipping area of the Dixie Cup factory in Easton, Pa. Not only does the clear-plastic pipe carry the containers overhead and out of the way of other operations, but it leaves them unmarked by their whirlwind glide.



NINETY POUNDS OF POWDER, stashed in two cans, with float lines attached, is ready to be dumped from chute on shot boat. Charges are exploded every 500 feet.

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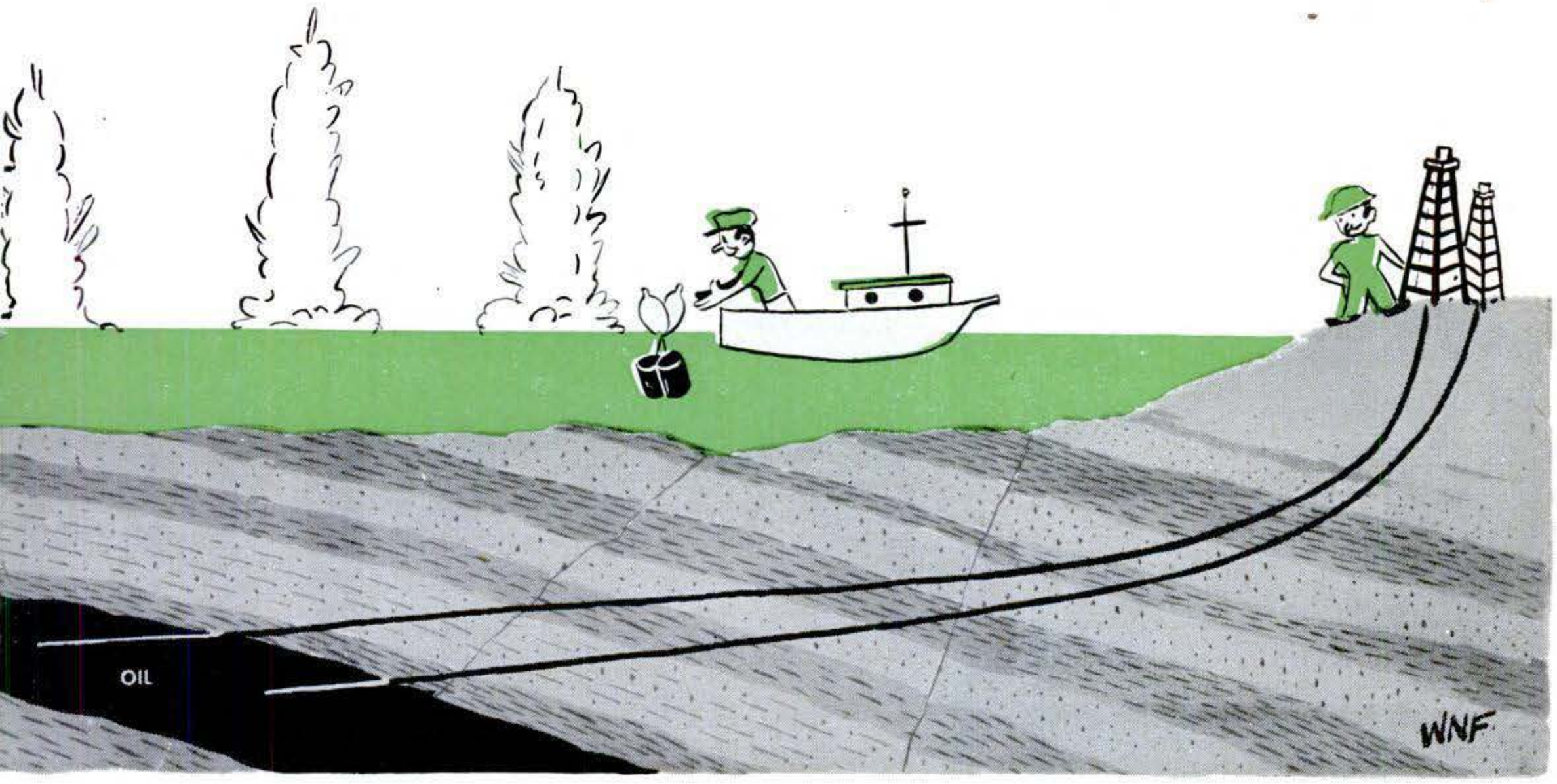
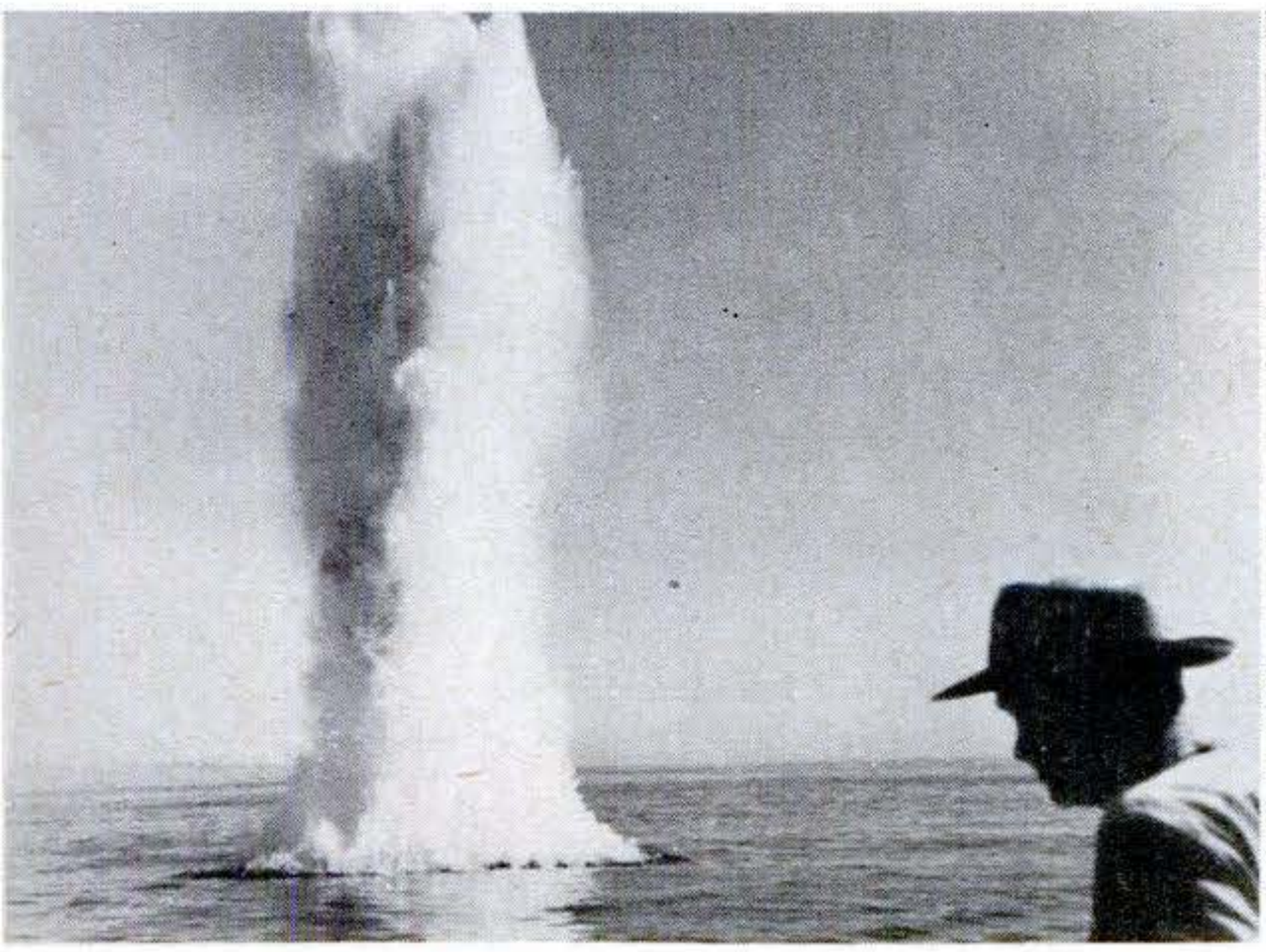
Depth Charges Spot Undersea Oil

SMALL fleets are pounding away at the coasts of California, Texas and Louisiana, rocking the continental shelf that runs far out to sea with a systematic barrage of depth charges. Scientists and oil operators are the bombardiers. In their search for new petroleum reserves, they are recording the shock waves set up as the explosions penetrate three miles of ocean floor.

Geophones, attached to cables which straddle the underwater blasts, transmit the impulses in the form of wriggly lines to ribbon-like seismograms. From these charts, trained crews get a clear picture of tideland earth strata, and know at exactly what depth oil may be found.

When a likely drilling site is located, it is plotted with a newly developed radio-navigation device called "Lorac" (short for Long Range Accuracy). Lorac uses land-based transmitting stations to pinpoint sites within 15 feet at 50 miles.





WATER SPOUT is only a fraction as high as downward thrust of explosion. Fish-and-game boat accompanies seismic fleet to prevent destruction of large schools of fish.

RECORDING BOAT does triple duty. Beside towing geophones, it carries seismograph which traces intensity of shock waves, and takes bearings of future drilling sites.

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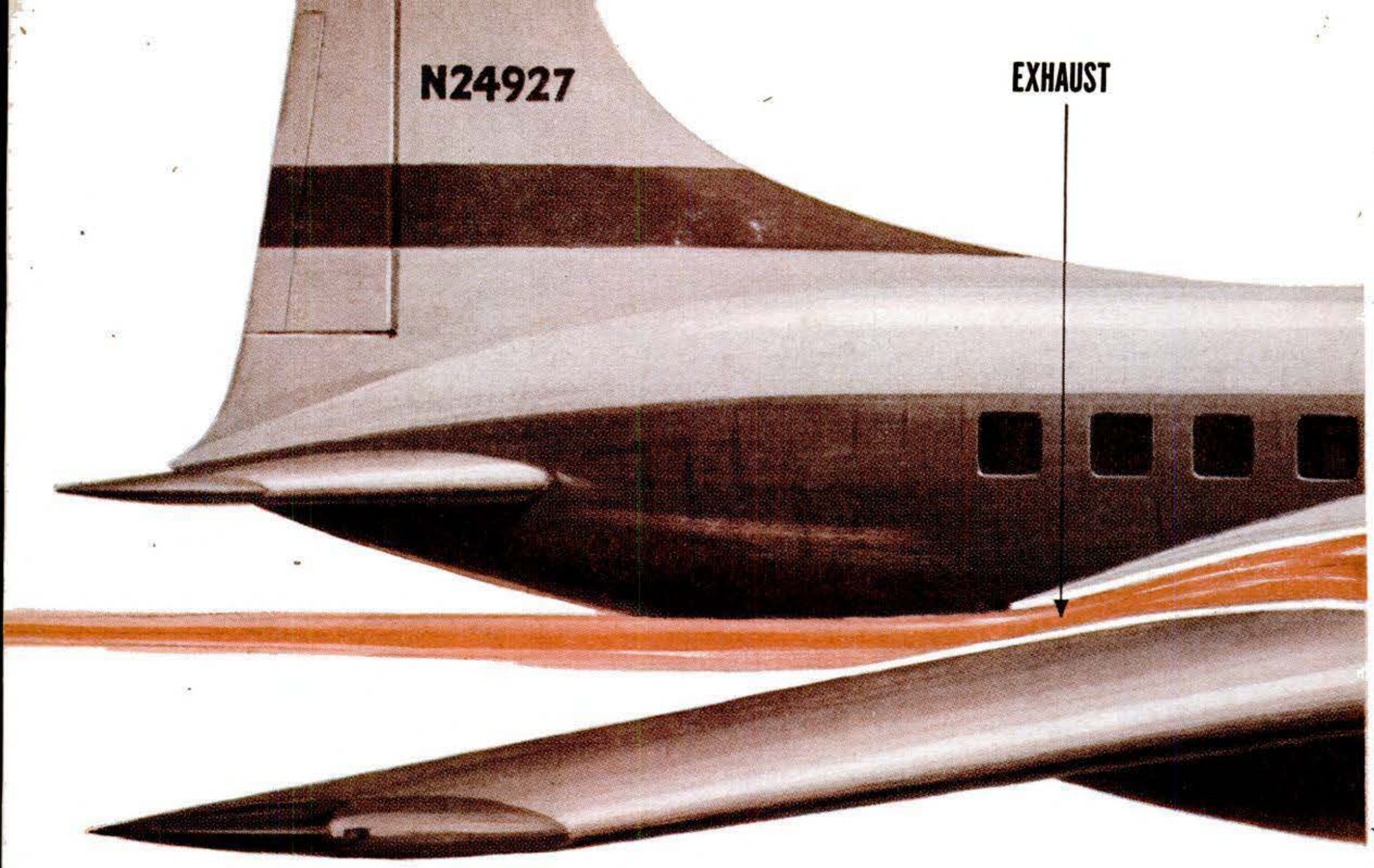
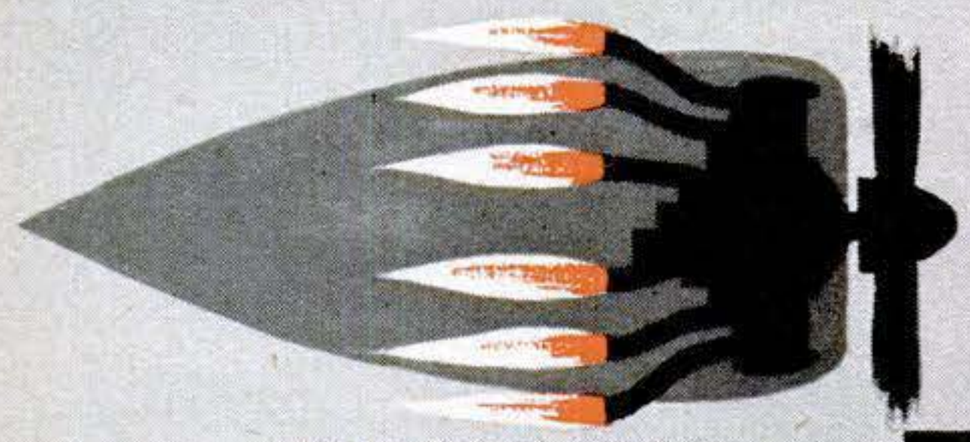
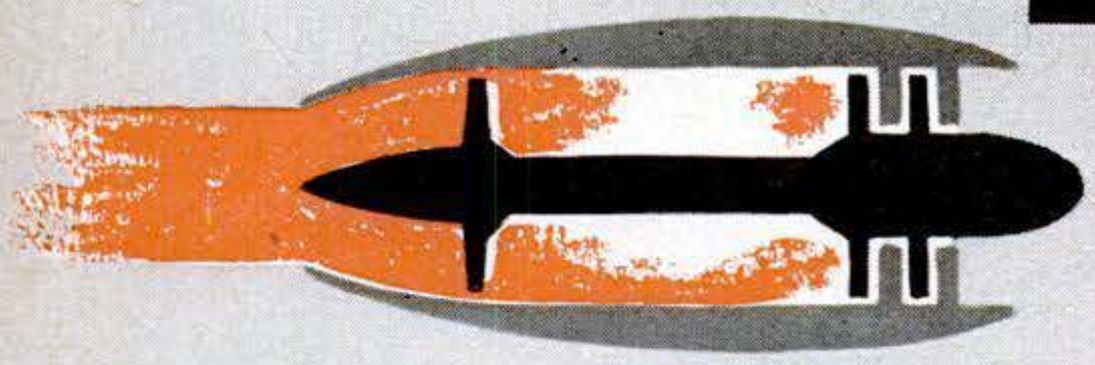
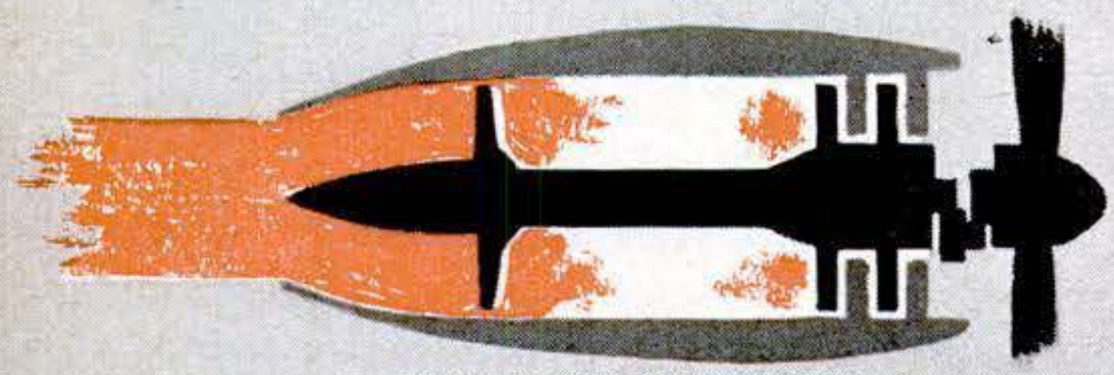


New Airliner

Three Ways to Propel a Plane


PISTON ENGINE AND PROP


PURE TURBOJET


TURBINE-PROP COMBINATION

By Devon Francis

THERE was something funny about the plane as it taxied toward the downwind lip of the runway. It looked like any other twin-engine airliner. But it sounded different. It was too quiet.

Instead of a series of staccato explosions from the engines, there was only a hum.

The pilot wheeled into the wind, released his brakes and the plane gathered speed. But the tone of the hum didn't

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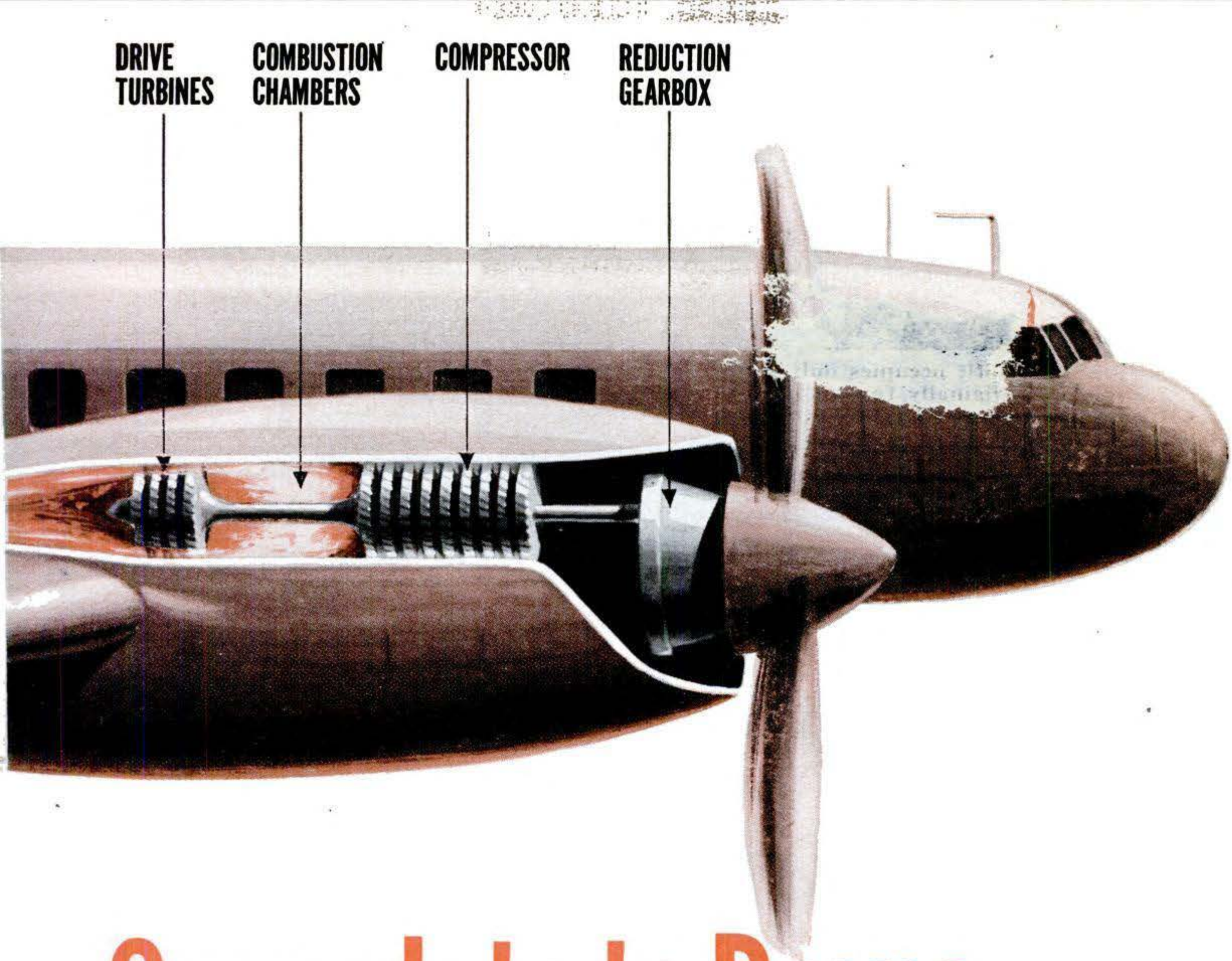

Gears Jets to Props

Gas turbines promise higher airline speeds as well as quieter, vibrationless flying.

change. It didn't grow. Some propeller noise merely was superimposed on it.

Then, of a sudden, the plane was airborne. It happened so fast that a spectator had to look twice to believe it.

This airliner was unique—it was, and remains, the only one of its kind in the U. S. It introduces a brand-new kind of flying. It's faster. It's smoother and quieter. It's known as a turboprop.

Turboprops are gas-turbine engines—the same kind of engines used in jet aircraft—hooked up to propellers. Until recently the gas turbine has been used only in military jets and in British-made jet transports. In those planes the turbines create a monstrous volume of hot gases. They stream out the tailpipes and propel the airplanes by reaction. Now turbines are being used to propel aircraft in another way. They turn propellers, as the more familiar piston engines do.

As the turboprop airplane came unstuck from the runway of Indianapolis' Weir Cook airport, the nose came up. It climbed faster than piston airliners

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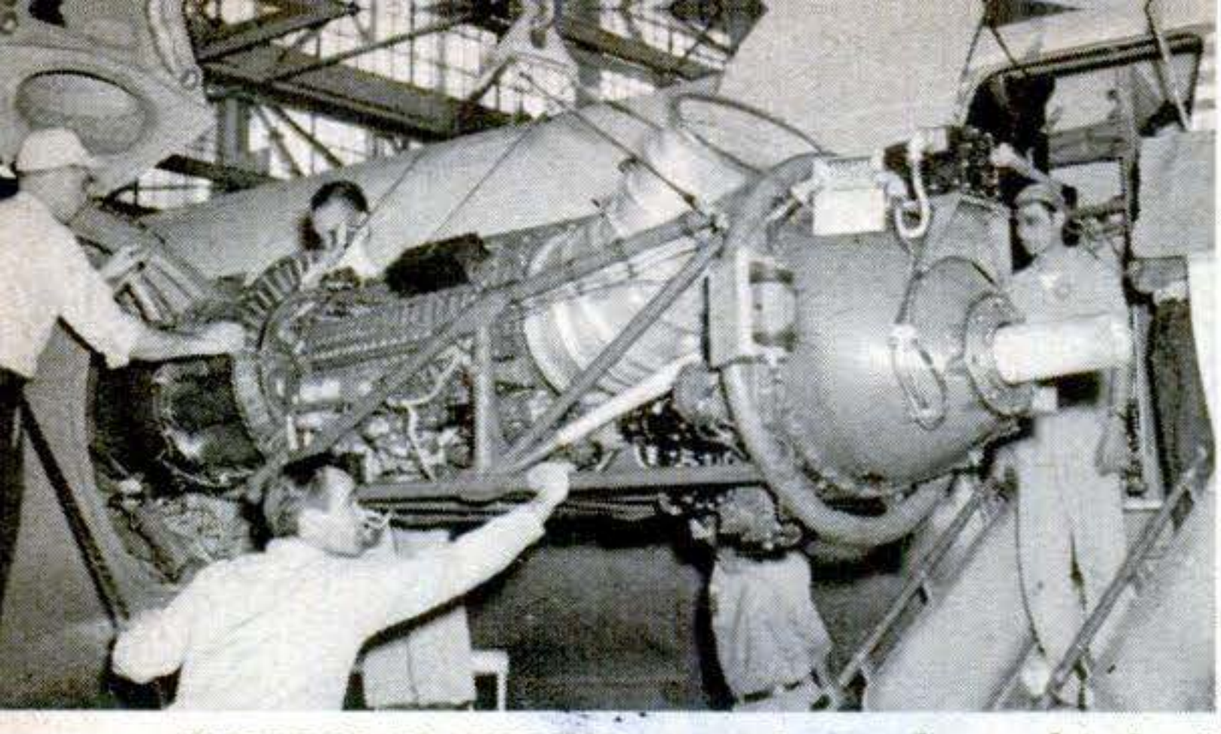
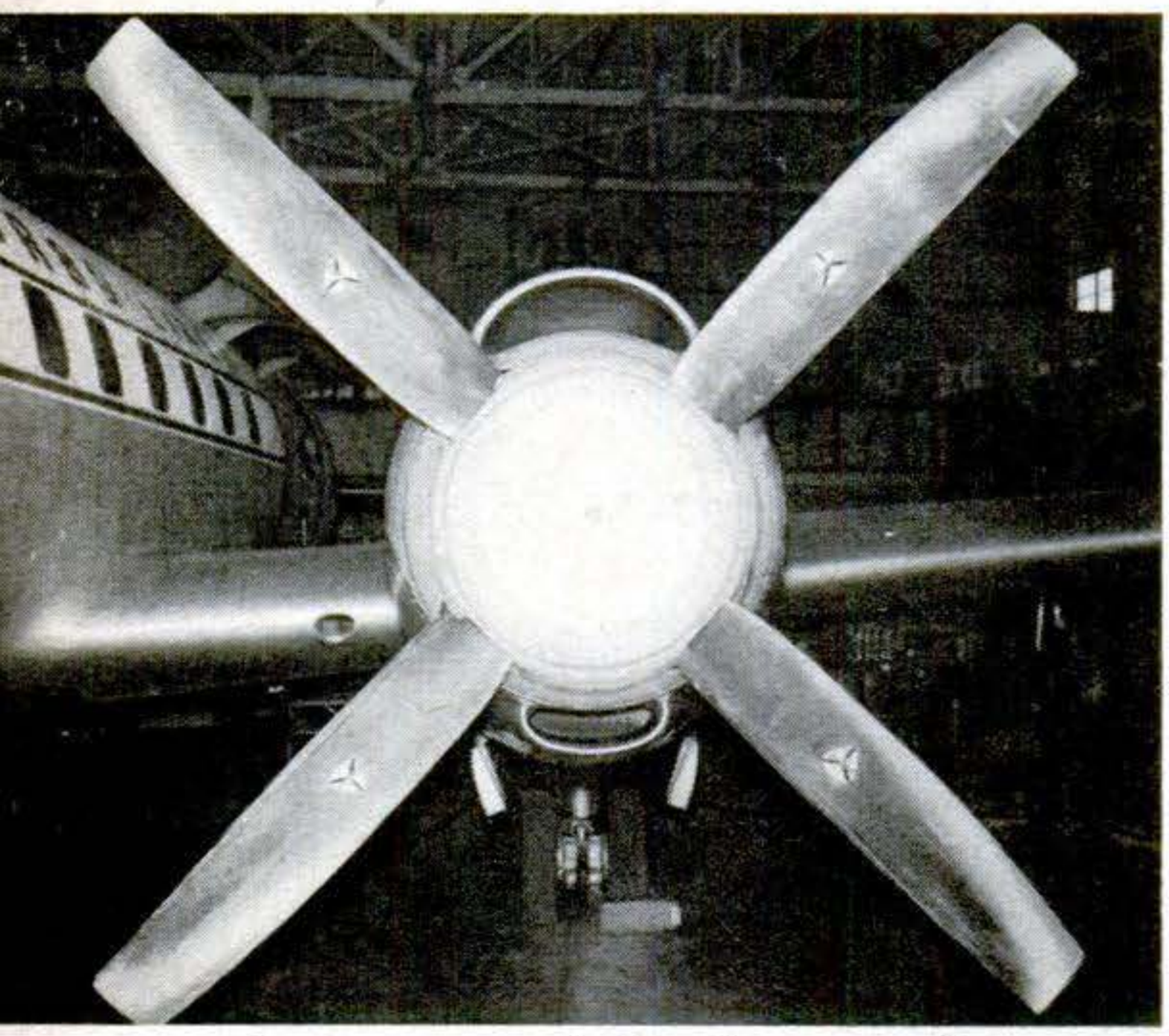
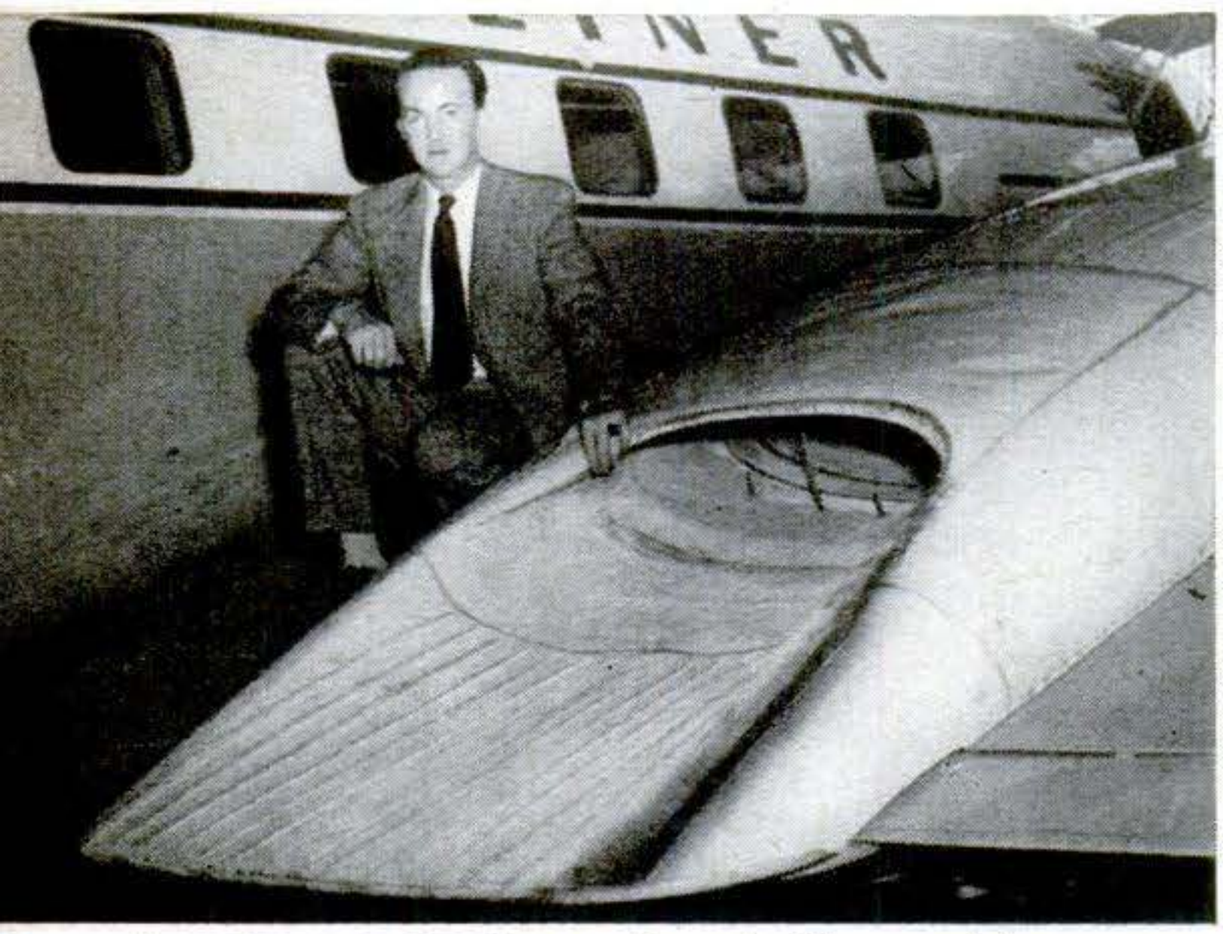


TURBOPROP ENGINE occupies only a third of nacelle built originally for piston engine in experimental plane. Turbines are started by tiny, built-in auxiliary turbines.



RATCHETS automatically disconnect big props from engines in case of engine failure. One engineer describes idea as having been borrowed "in toto from an old Maytag washer."



JET EXHAUSTS boost speed. But turbines turning props take so much energy from gases that gas velocity at exit is only 600 feet a second compared with 1,700 in pure jet.

are capable of climbing—at a rate of a half-mile a minute. Presently it leveled off in cruising flight.

The noise level was low for passengers, crew and people on the ground. Around the Indianapolis airport the Turbo-Liner, as it's called, is dubbed "the flying sewing machine."

But even more evident than the low decibels was the low level of vibration as compared with that in piston-engine airplanes. It was like cruising at 60 in a car on a mirror-smooth highway.

As the Turbo-Liner completed its "climb-out," it drew up alongside an American Airlines transport Chicago-bound. The other plane was a duplicate of the Turbo-Liner—except for power. It had two piston engines producing 4,200 horsepower and weighing more than two tons. The Turbo-Liner's engines produced 1,300 horsepower *more* and weighed less than a ton and a half. The other plane's flight time to Chicago, 170 miles away, was 53 minutes. The Turbo-Liner could make it in 37.

Turbo-Liner Pulls Away

Pacing the other plane, a Convair 240, the Turbo-Liner was registering 220 miles an hour. Then it pulled away. In 40 seconds it had reached an indicated speed of 290 miles an hour. Corrected for altitude and outside air temperature, the actual speed was more than 300 miles an hour.

A few minutes later the plane coasted in toward the runway. The wheels touched. Suddenly the big machine slowed to a walk.

The engines hadn't changed tone. The props hadn't been reversed. The brakes hadn't been applied. The plane stopped like a quarter-inch electric drill when a fuse blows.

This new turboprop airliner, the property of the Allison Division of General Motors, is still experimental. Powered with two Allison gas-turbine engines, it can still be vaguely identified with jet airplanes.

Of the 2,750 horsepower that each of the two turbines develops, 10 percent

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comes from jet propulsion. The rest is pure shaft horsepower produced by power plants whirling at 14,300 revolutions a minute. Airplane piston engines turn over at about 2,000 r.p.m. Extension shafts run from the Turbo-Liner's engines to gearboxes where the props are geared down to approximately the same speed as those of piston engines.

Unlike piston engines, the Turbo-Liner's turn at practically the same speed all the time—idling and in full flight. The only factors that change much are the rate of fuel flow and the pitch of the propellers. The blades go all the way from reverse through neutral to full cruising pitch.

The Turbo-Liner is simpler to fly than a piston-engine airplane. The pilot has a single lever control for each engine that replaces five separate controls in a conventional airplane—the throttle, prop pitch, fuel mixture, supercharger and carburetor heat. For take-off, landing, taxiing and parking, he can go from reverse to take-off power merely by moving the lever back and forth.

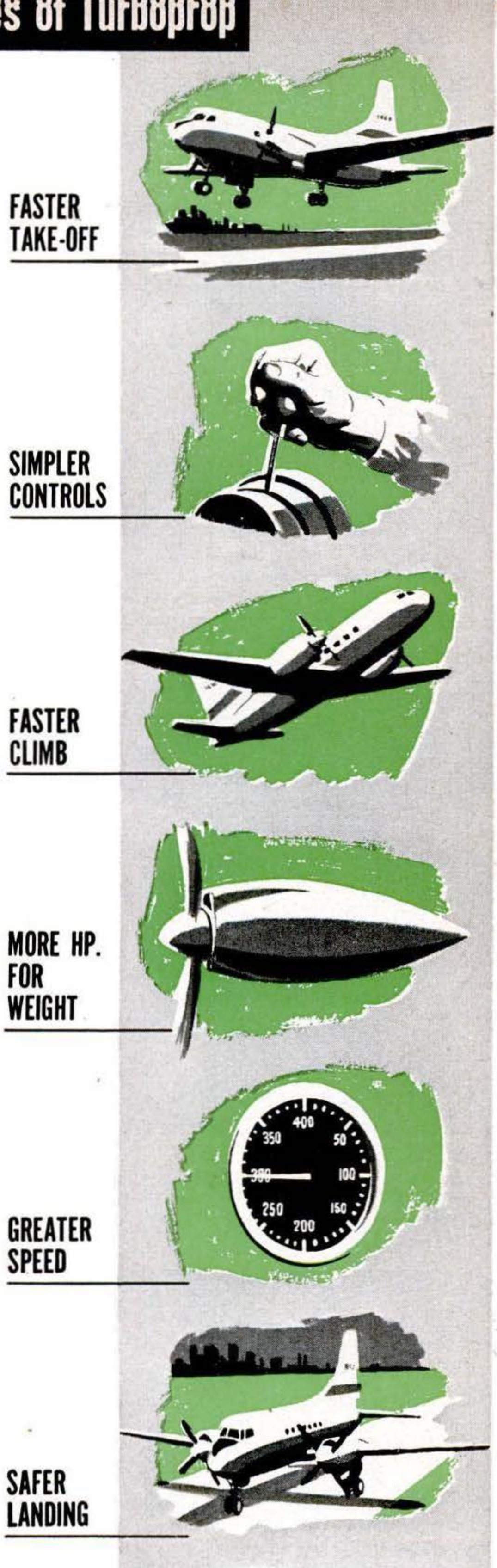
Uses Few Instruments

He can fly on an unusually small number of engine instruments—a tachometer (marked off in percentages of full power instead of r.p.m.), a turbine-inlet-temperature gauge and some fuel and oil-pressure gauges.

If the turboprop airplane is so good, why did it take so long getting here? The fact is that for regular airline service on this side of the Atlantic it isn't here yet.

The turboprop was a long time coming because the gas-turbine engine has a Jekyll-and-Hyde personality. It's brilliant but ornery.

Take engine failure, for instance. If an engine on a piston transport fails, the pilot cuts his switch and feathers his prop, and that's that. With a turboprop, the resistance of a dead turbine to its windmilling propeller would be so great that the drag could throw the plane out



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PILOT VERNON A. FORD moves only two levers controlling engines and props. In place of manifold-pressure gauge to show power, he watches turbine-inlet temperatures.

KING-SIZE cargo door is six by eight feet. In the opinion of one aeronautical engineer, turboprop's greater efficiency will lead to lower airline tariffs.

TURBO-LINER "breaks ground" quickly, climbs more than twice as fast as comparable piston-engine plane. Turboprops can bring faster airliners into airports too small for jets.

of control before the prop could be feathered.

So the engineers literally broke in two the shaft connecting engine with gearbox and prop. The shaft is splined at the break and spring-loaded so that the two parts become one under normal operating conditions. If an engine quits in mid-air, its inertia, tussling against the effort of the air stream to turn the propeller, overcomes the spring tension and separates the two parts of the shaft.

Range of Engine Speed Is Slim

The simplicity of control is only a by-product of the effort to harness an engine that likes its own head. The range of engine speed—from 12,500 to 14,300 revolutions a minute—had to be kept slim because of a peculiarity of the gas turbine. It isn't "self-sustaining"—it won't keep going on its own—under 5,000 r.p.m. Moreover, when the fuel flow is reduced, a turbine falls off rapidly, as much as 2,000 revolutions a *second*. In flight, the r.p.m. is constant at 14,300.

So keeping up the speed is essential. That led to the single lever. A pilot can't kill an engine with his throttle because the lever won't bring its r.p.m. below 12,500. Only a special fuel-cutoff valve will shut it off.

Engine speed is only incidental to power output. As more fuel is poured into the engine, the tendency of the engine to speed up is offset automatically by a higher pitch, producing more thrust and maintaining constant speed.

The willingness of a turbine to quit working as soon as the fuel flow is cut down is turned to advantage in landing. The wheels touch, the pilot retards his control levers, and the propellers come back to flat pitch. But the air stream still tries to turn them. The turbines object, high drag sets in, and the plane slows to a crawl on the runway in almost less time than it takes to tell it.

The almost-constant engine speed is a guarantee of full power if a pilot misjudges a landing and has to try again.

[Continued on page 226]

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There's a Surprise Under This Hood

Turn the Page to See the Engine

Even a traffic cop would have to unbend to give the low-down to the driver of this latest of the British little-car arrivals.

IF YOU like your motoring in a small package, a Sharp's Bear Cub—one of Britain's latest car exports to this country—gives it to you with comfort, economy and that Continental look.

It's a three-wheeler, but the big bonnet (hood to you) and the fancy front fenders stack up with the substantial appearance of its little four-wheeled brothers. Seating two, there's plenty of leg-stretch room under the hood for both driver and passenger to ride comfortably.

And this Bear Cub is no chowhound—it cruises at 40 miles an hour on a diet of 77 miles to a gallon. Top speed is 50.

A 420-pound bantamweight, the midget car is 116 inches long, 57 inches wide and 45 inches high. Its aircraft-riveted, stressed-skin aluminum-alloy body combines light weight with rigidity. Other features include three-wheel brakes, a one-piece, curved safety-glass windshield, electric windshield wiper, individually controlled twin spot-lights, and even turn lights that pop out of the front fenders.

Top and side curtains, the latter carried

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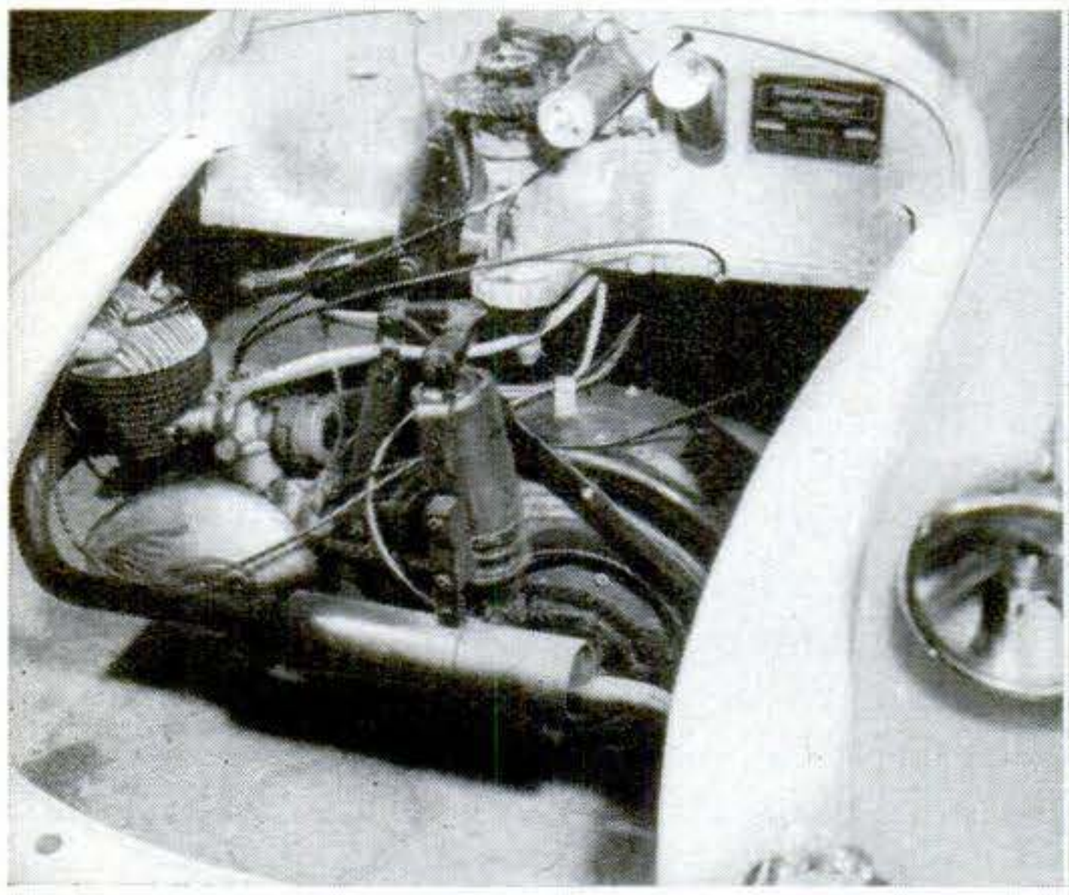
The Engine Turns with the Wheel

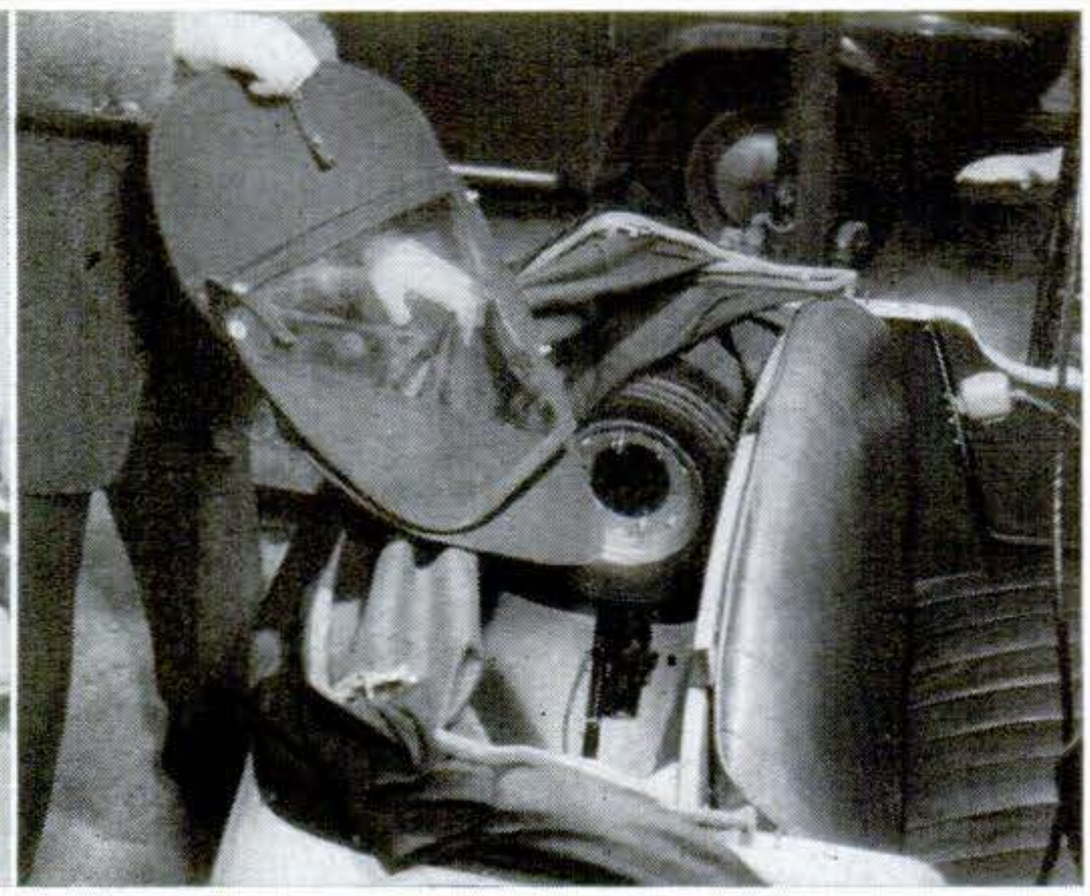
UNDER THE HOOD, mounted on the front-wheel unit, is this eight-horsepower, two-cycle Villiers air-cooled motorcycle engine. Transmission is by endless sprocket chain.

in the luggage compartment, are made of a woven-plastic fabric that is said to be shrinkproof. The one-cylinder motorcycle engine is manually started from the driver's seat by a pull lever, assisted by an automatic decompressor. There are three speeds forward. Reverse and a self-starter are supplied as extras.

The U. S. distributors of the Bear Cub, Craven & Hedrick, Inc., 522 Fifth Ave., New York City, quote the price, delivered in New York, at $895.—*Herbert O. Johansen.*



FRONT WHEEL and engine can be turned by the driver a full 90 degrees in either direction. This enables the Bear Cub to be turned in its own length, pivoting on its rear wheels.



LUGGAGE COMPARTMENT behind seat has about 20 cubic feet of space. In it are carried, as standard equipment, side curtains, spare wheel and tire, and a small tool kit.

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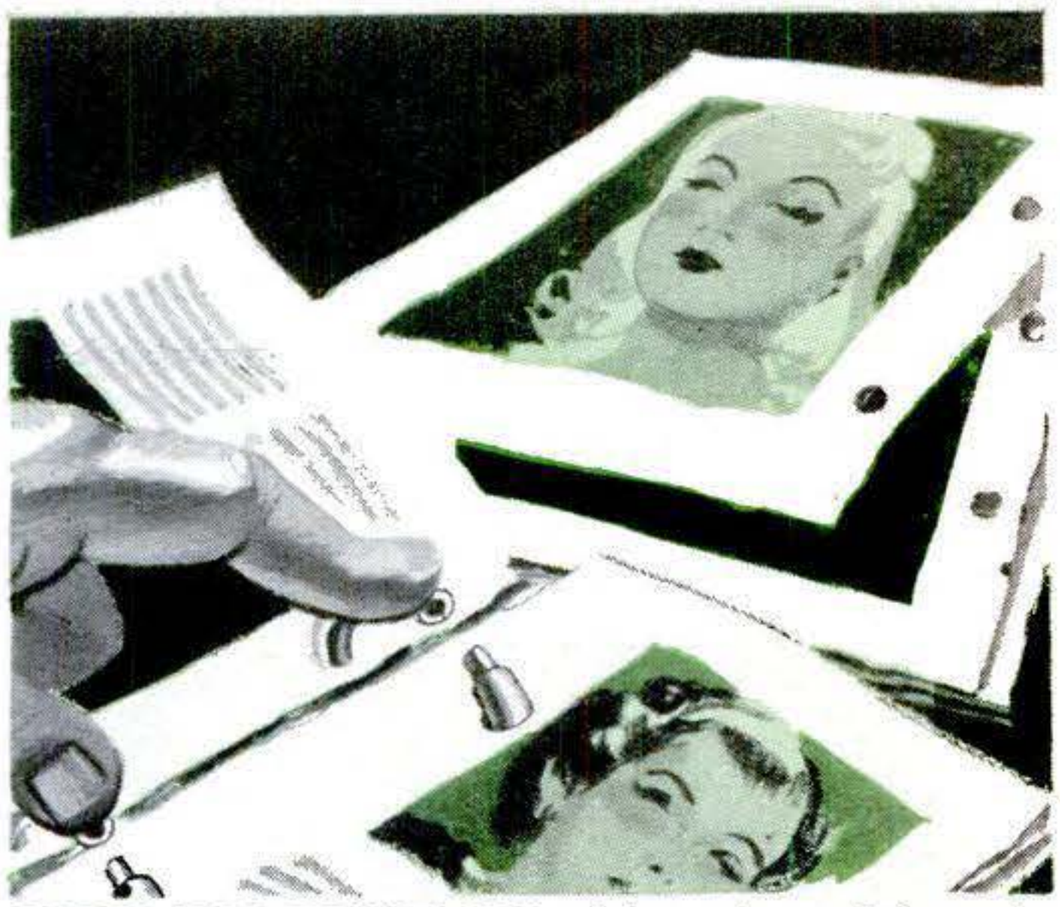
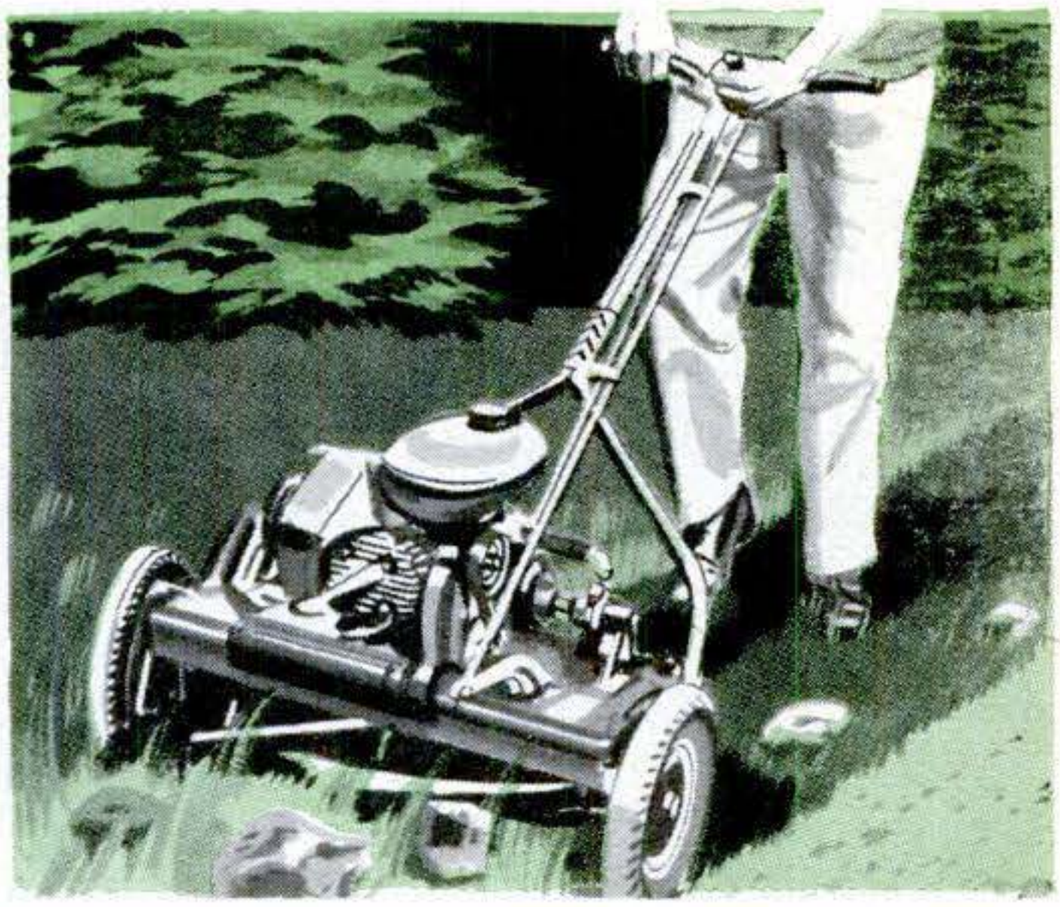
I'd Like to see them make...

Everyone has his own pet idea of some gadget he would like to see in general use. What is YOURS? *Popular Science Monthly* will pay $5.00 for each one published. Use government postcards only. Contributions cannot be acknowledged or returned.

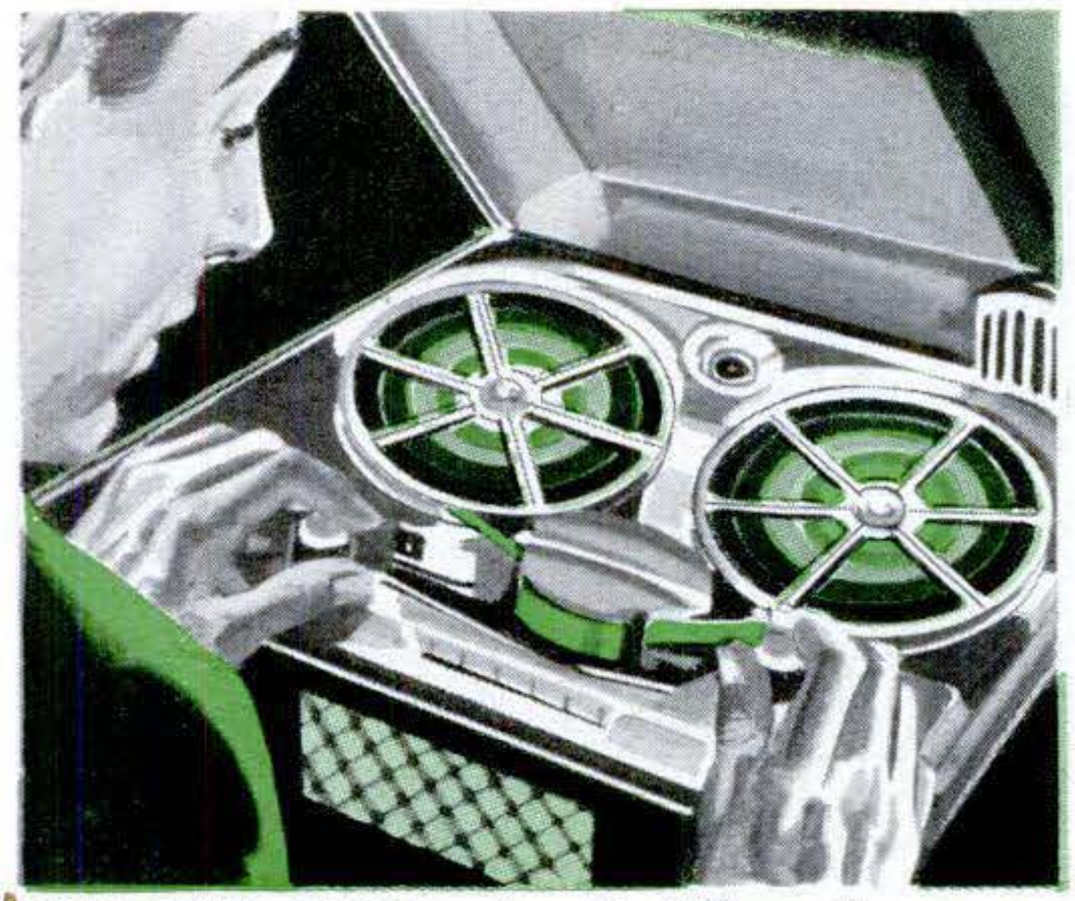


LOOSE-LEAF NOTEBOOKS with male and female rings to cut holes in papers and clippings, eliminating need for a paper punch.—*Wm. Wilson Jr., San Diego, Calif.*

A FAUCET that could be swiveled to spout upward, forming a drinking fountain. It would eliminate a lot of glass washing.—*F. A. Lee, Williamsburg, Va.*



A POWER LAWN MOWER with a control on the handle so the blades could be raised to allow the wheels to roll free over rocks.—*Donel Dell, Sheridan, Ind.*



RECORDING TAPES colored differently every few feet, so locating a spot for playback or figuring length of recording would be easy.—*M. A. Lindesay, St. Thomas, V. I.*

JALOUSIE WINDOWS FOR CARS. The glass slats could be opened even in rain, and in good weather you'd get plenty of air without drafts.—*Lucille Denton, Grand Haven, Mich.*

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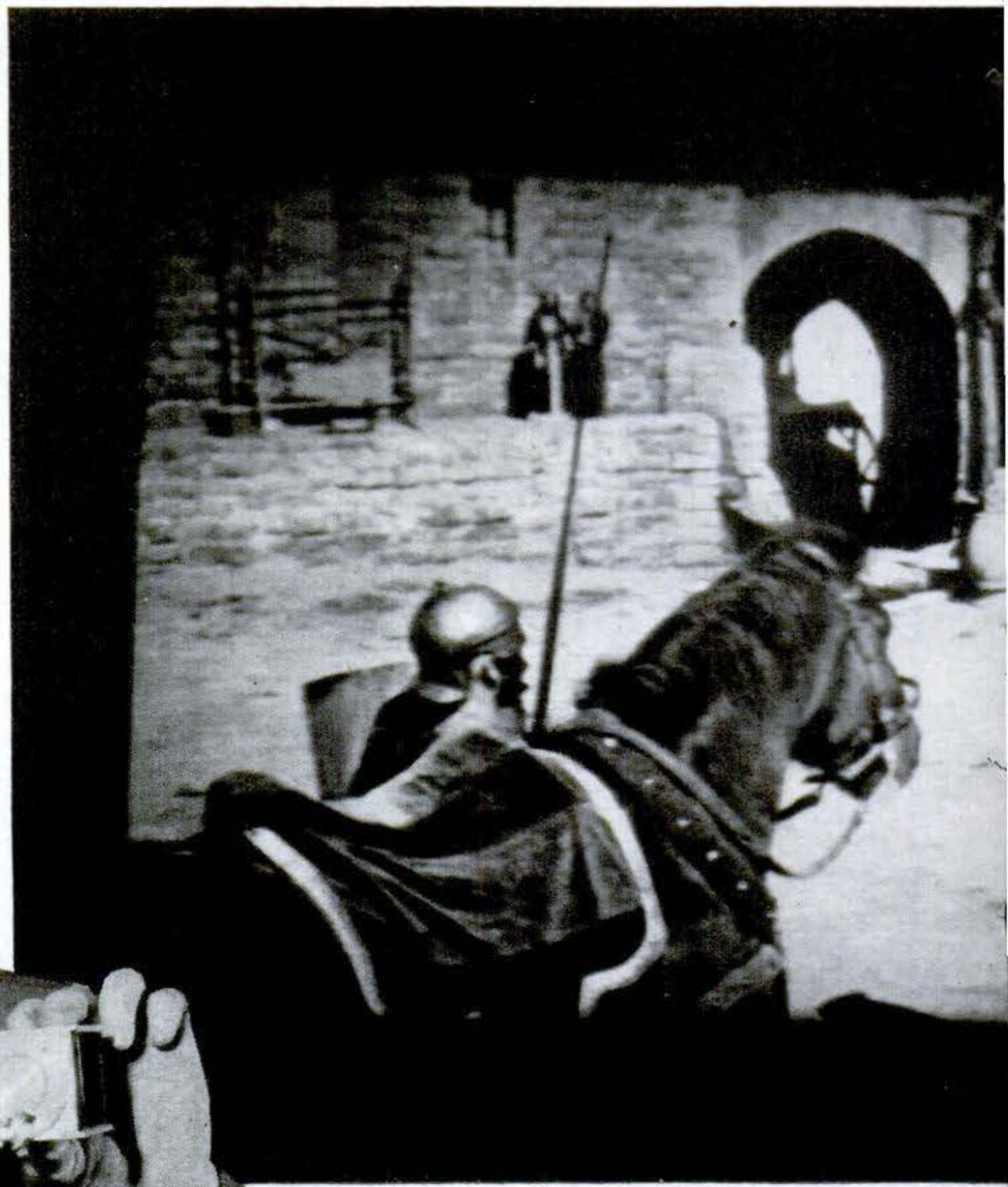
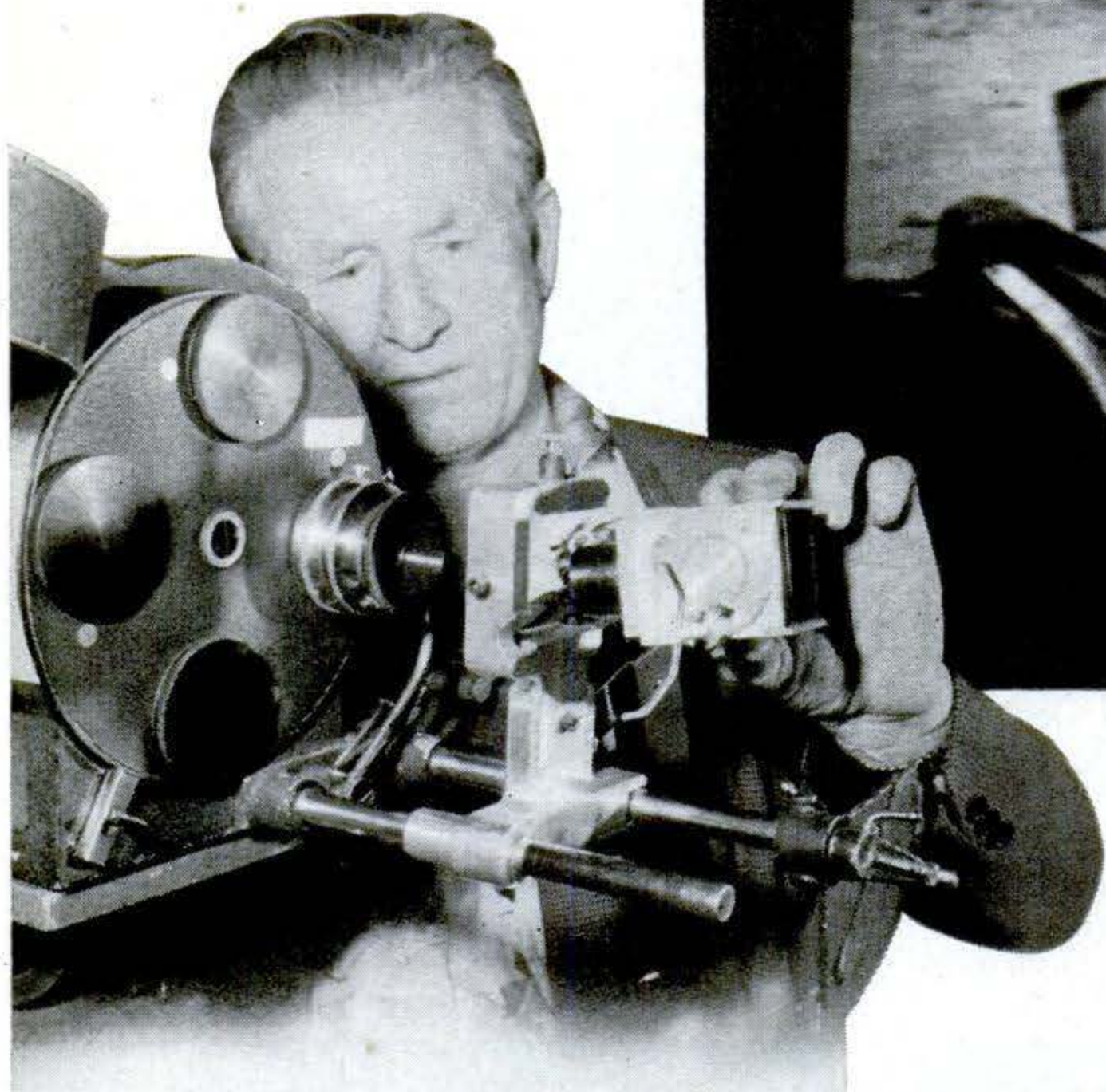
HERE'S WHAT YOU'LL SEE in Cinemascope's first Technicolor offering, *The Robe.* Although the horse at left of picture spreads 25 feet across the screen, your eyes will be drawn to Marcellus and the centurion, at center, through subtle lighting and boosted output of loudspeaker directly above them.





ANAMORPHOSCOPIC LENS UNIT is slipped into mount on standard 35-mm. camera. Cinemascope sets must be flooded with intense light to compensate for stopped-down lens opening which brings all parts of the huge picture area into sharp focus.

CONVENTIONAL MOTION PICTURE LENS records what it sees without distortion, but its three-units-high by four-units-wide proportions limit the field of vision.

DUPLICATING HUMAN VISION, Cinemascope's anamorphic lens takes in an area one unit high by three units wide, then compacts it on standard-width film.

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"Squeezed" Movies Challenge 3-Ds

Trick lens condenses huge Hollywood sets, then stretches the picture out again—across gigantic 80-foot screen.

By Andrew R. Boone

IN A multimillion-dollar bid to woo you and the missis back to the Lyceum, Twentieth Century-Fox is blowing the dust off a 16-year-old camera lens that turns out the world's zaniest pictures. Point this oddly shaped glass assembly at Burl Ives strumming a guitar in the shade of an old oak tree, and he comes out looking like Frank Sinatra tooting an oboe under a grapevine.

And that's only half of it. To its right and left this anamorphic lens has scanned twice as much scenery as a conventional camera lens, and squeezed it all on a single, standard-width film.

Run this through a projector equipped

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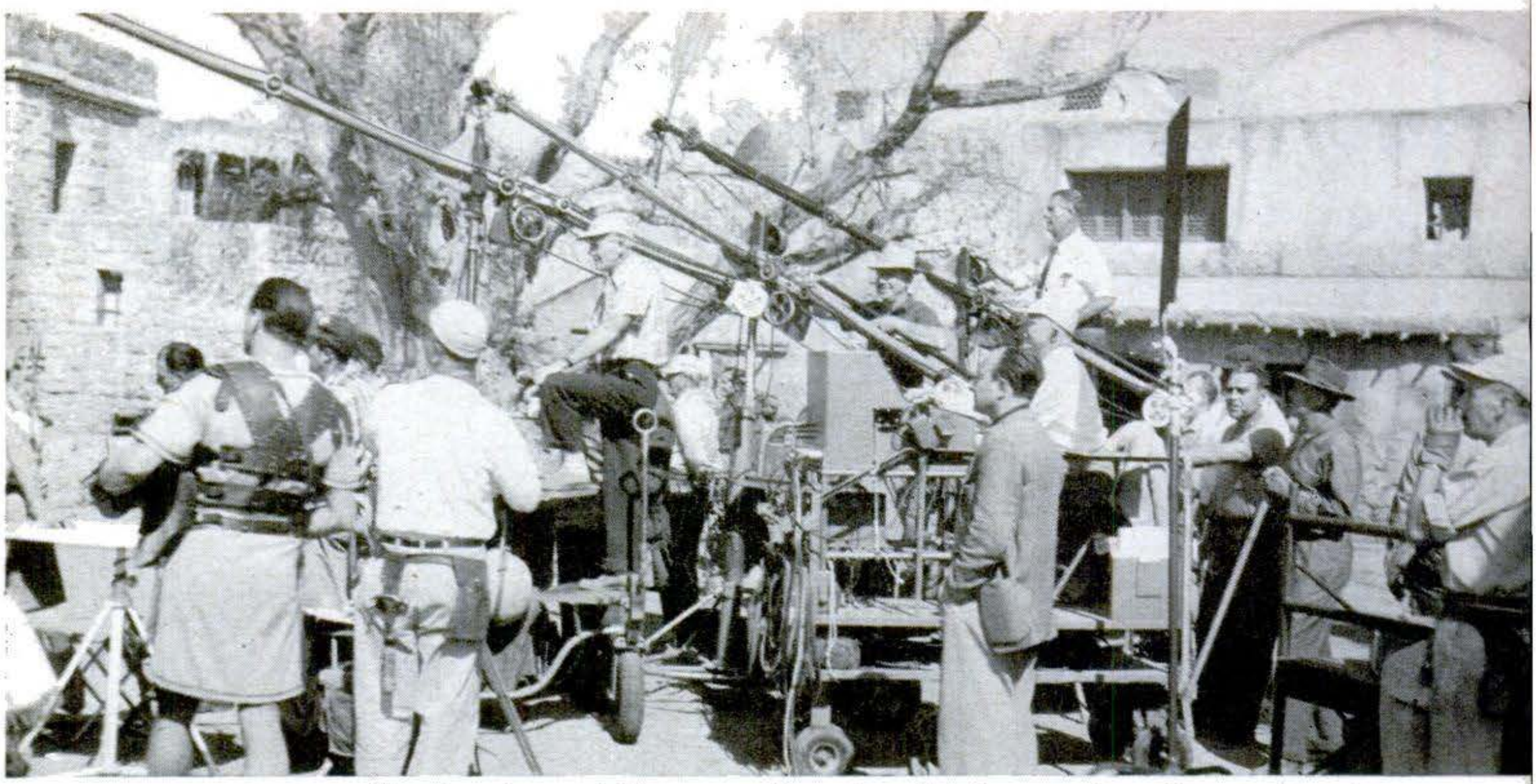

STEREOPHONIC SOUND calls for three dolly-mounted microphones, whose shadows must be flooded out with special lighting. Twentieth Century-Fox is testing the comparative quality of multiple sound tracks on the picture film, and independent sound tracks which would be synchronized in theater projection booths.

with another anamorphic lens and—presto—Burl Ives expands to his proper proportions, flanked by a breath-taking setting half a city block wide!

Not since Al Jolson opened his mouth to fill American flicker houses with synchronized sound, has science offered the movie industry anything so charged with entertainment possibilities as this amazing peripheral-vision lens developed in 1937 by a modest French scientist named Henri Chrétien.

In a neat housing hardly larger than a king-size pack of cigarettes, the anamorphic lens produces a wide-screen picture comparable in size to the image achieved by Cinerama. But unlike Cinerama, Cinemascope (Twentieth Century-Fox's trade name for anamorphic productions) has no disturbing, film-lapping edges, no change of color values.

Different from Wide-Screen Classics

Don't confuse Cinemascope with so-called wide-screen classics now going the rounds of the larger metropolitan theaters. Unlike Cinemascope, they are narrowed-down, conventional films. Quick-change artists have simply placed a shallow mask behind the film track of a standard projector, then spread the image with a wide-angle lens.

Apart from scalping the actors and chopping their legs off at the thighs, it also magnifies the film grain to the atom-smashing point, giving fair-faced starlets more freckles than Arthur Godfrey.

Cinemascope, too, must be magnified. But because the height of the image has not been reduced by the anamorphic lens, the grain appears on the screen in the form of barely noticeable microscopic horizontal threads.

But the real impact of Cinemascope will come from brand-new technical tricks and radical changes in film directing. If you have seen Cinerama you know how wide-screen productions can engulf you in a Technicolor arc charged with breath-taking action, beauty and stereophonic sound. That two-hour assortment of shorts used every ocular and audio gimmick of the trade to chill and thrill you.

Cinemascope must do more. To take a permanent place in the entertainment world, it must make you forget that it

[Continued on page 210]

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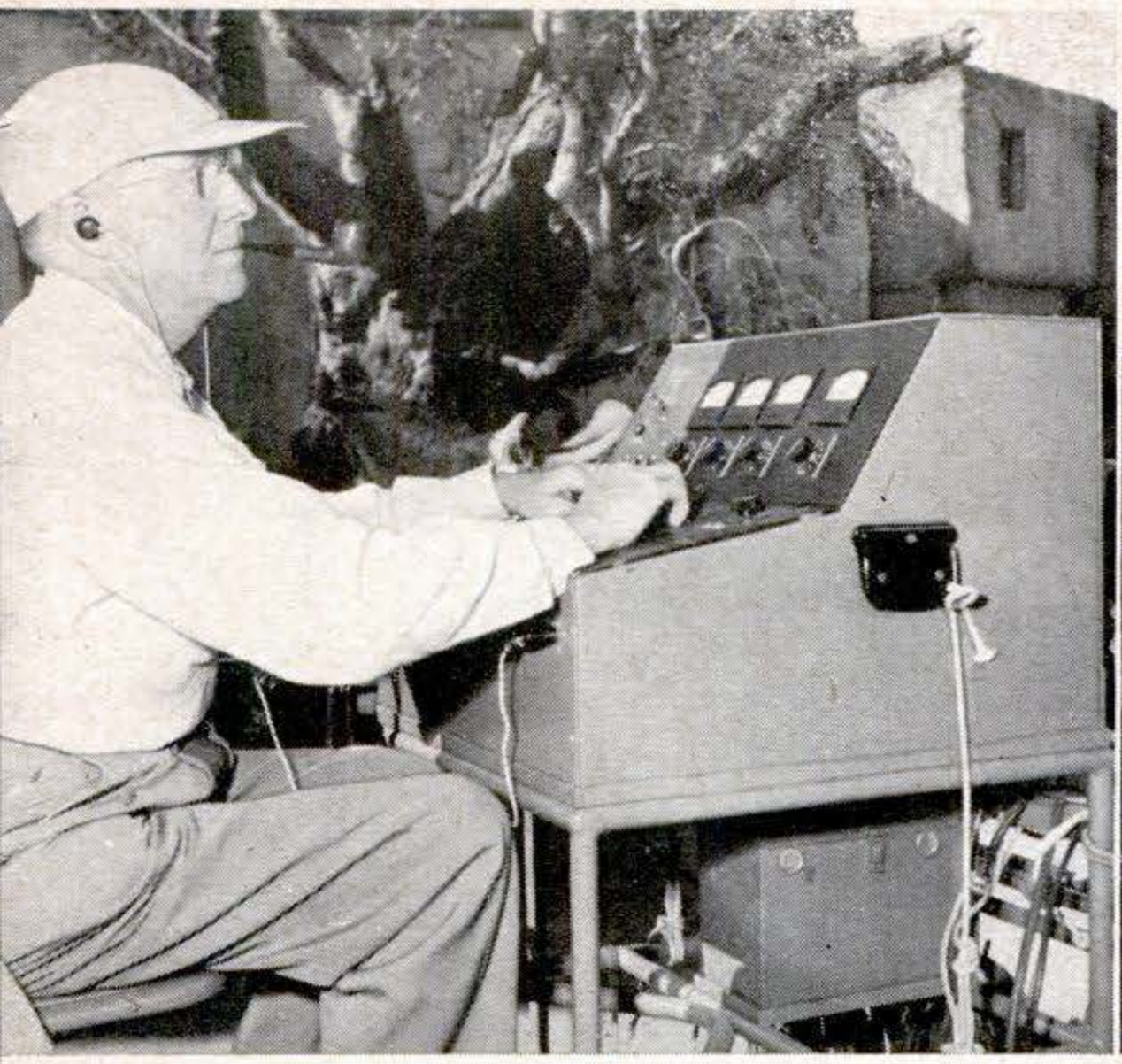
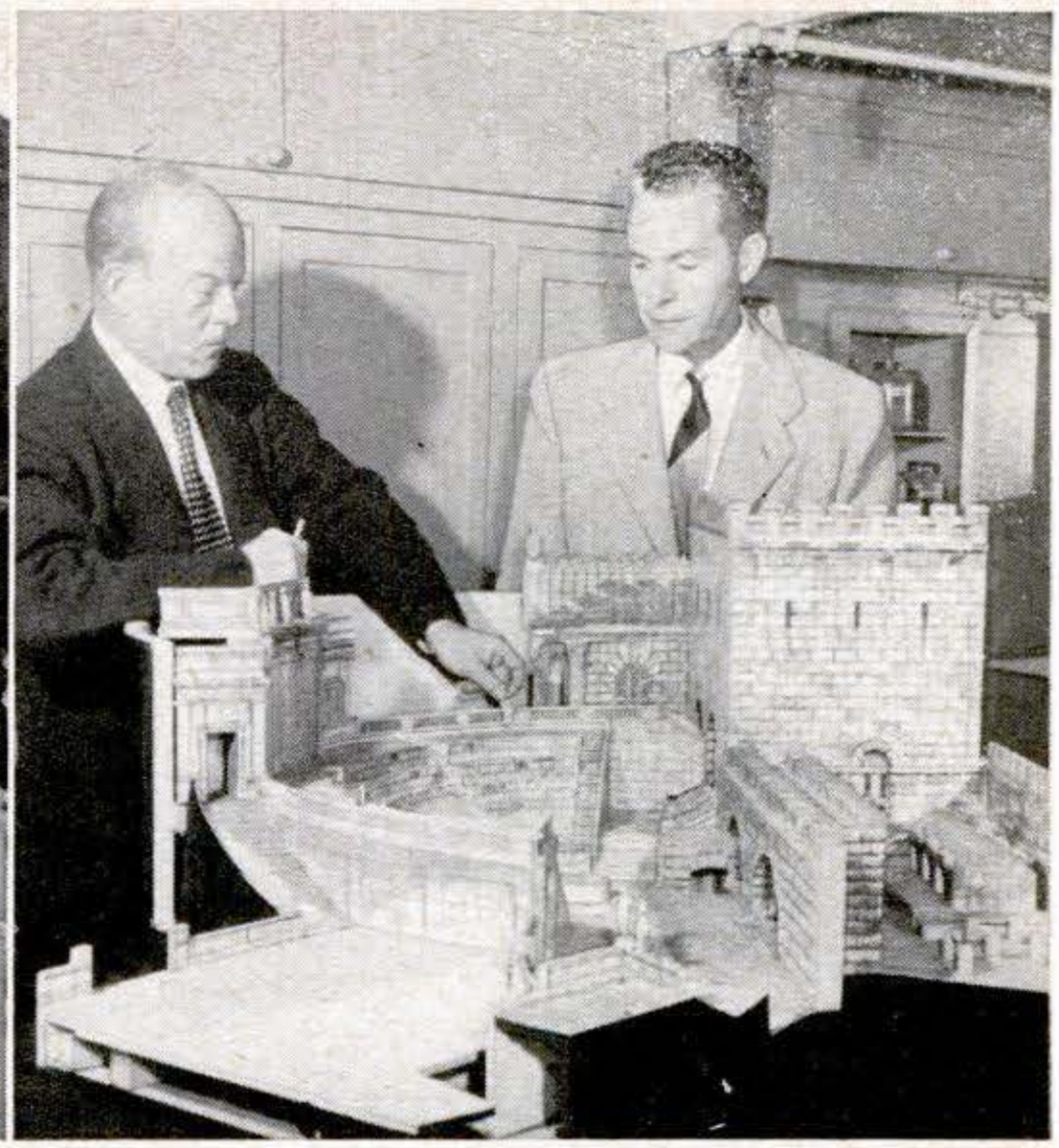
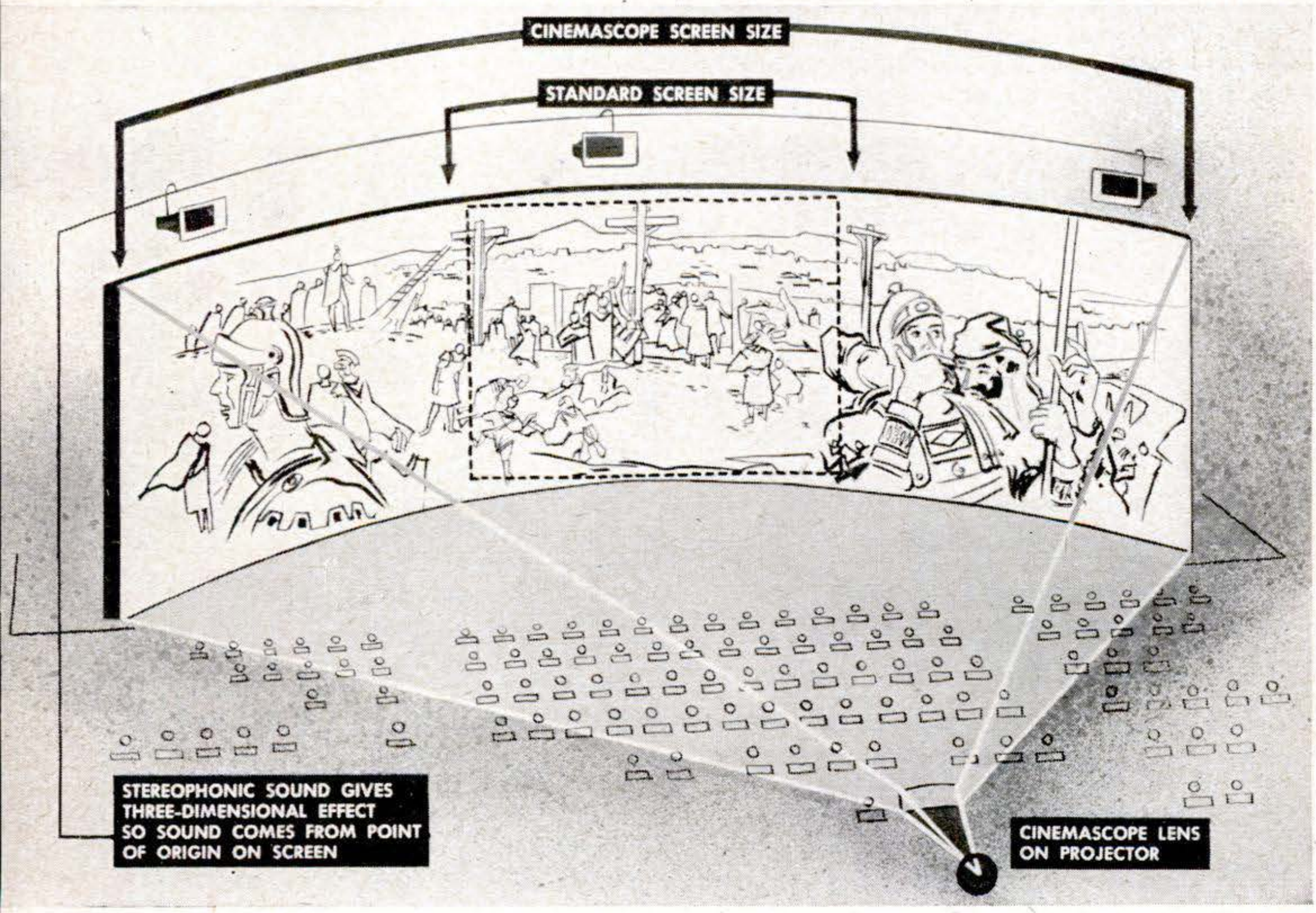


MICROPHONE PICKUPS are boosted or shaded right on the set. Sound man watches action and coordinates dial settings on this mixing panel. Sound is magnetically recorded.



DIRECTOR'S PREVIEW of $50,000 slave market set—one of 39 used in *The Robe*. Smooth picture action which makes for greater screen realism is plotted here.

CINEMASCOPE SCREEN is curved, but not as much as Cinerama's. Purpose is to maintain sharp focus throughout the width of the picture. Because screen size is greatly increased, its surface is mirrorized with millions of tiny lenses to reflect more light. Cinemascope's three loudspeakers duplicate positions of recording microphones.



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Pick It Up and Set It Down—Jawohl, You're In!

If you do a slow burn every time you drive round and round the block to find a big enough parking space—if you often wish you could lift the rear end of your car into a tight spot—the fräulein above is demonstrating just the car for you. The Kleinschnittger, Germany's newest, smallest car, it weighs only 300 pounds.

Hansom Cab Goes Electric

Closer to the ground than the old electric auto and faster than a horse-drawn hansom, the electric taxi above is a cross between the two. It made its debut shuttling tired sightseers between exhibits at the Milan Industrial Fair in Italy.

Cab Split to Stretch Truck

Half a loaf, they say, is better than none—but here's a case where half a cab is better than a whole one. Space gained allows a 20-foot-long platform for lumber. The custom-built body is set low on the Dodge truck chassis to allow loading by one man.

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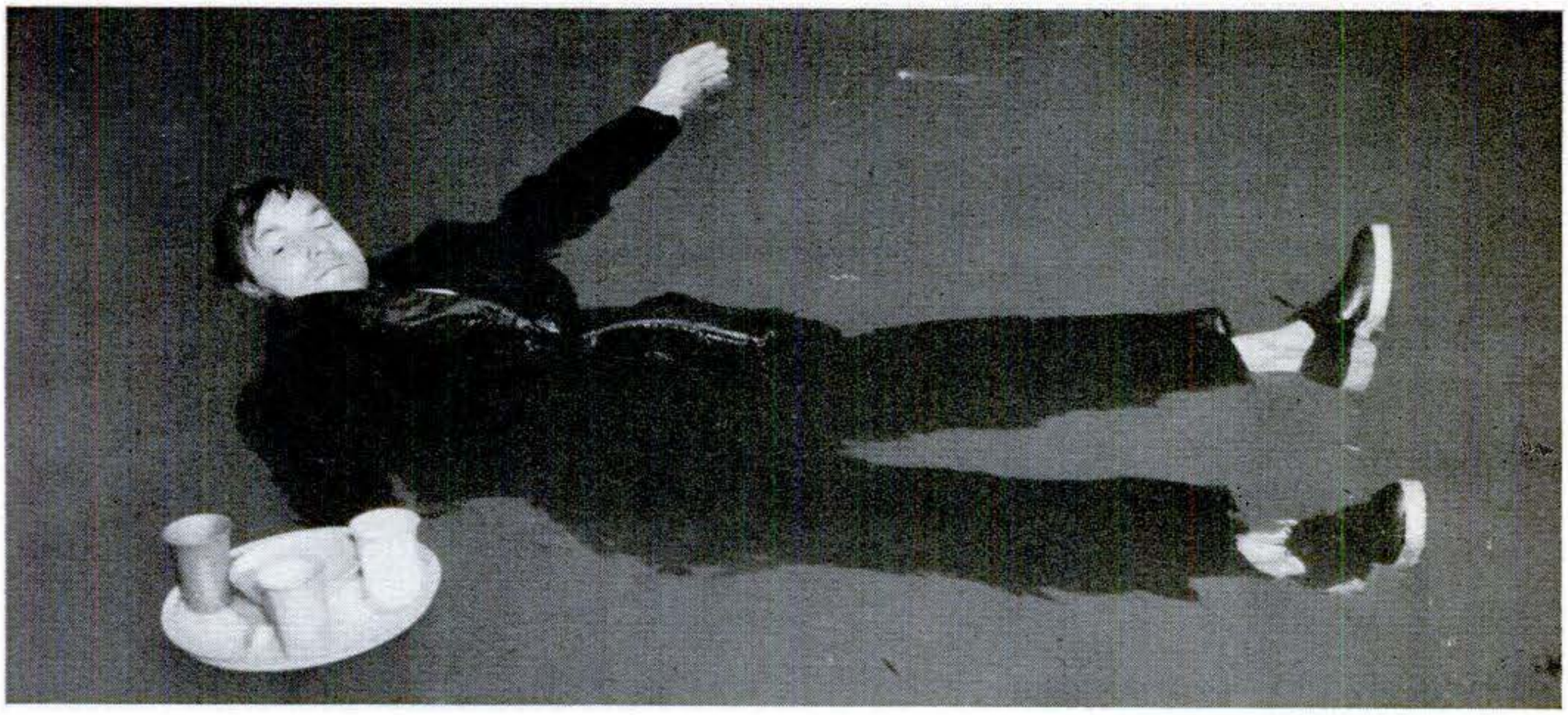
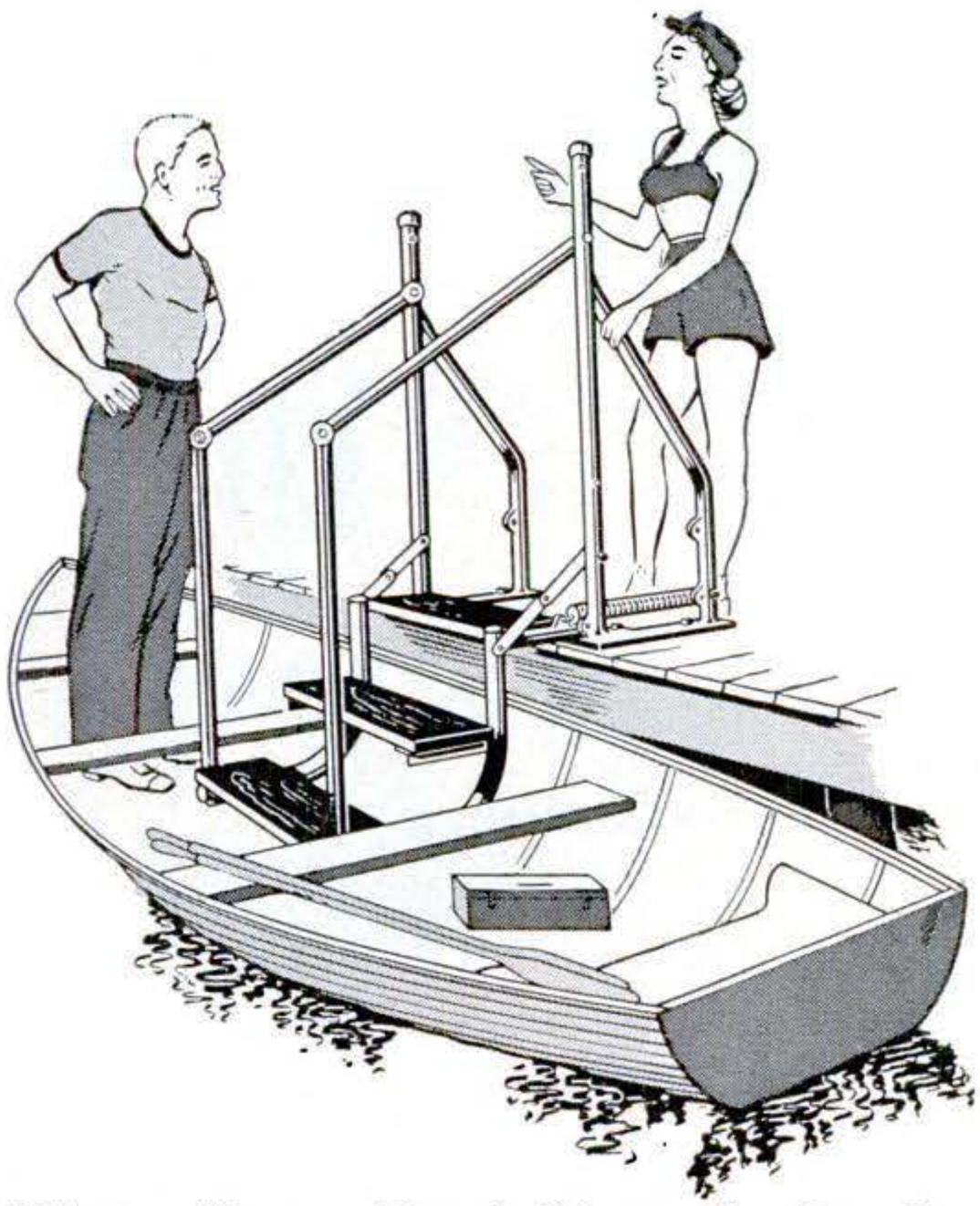


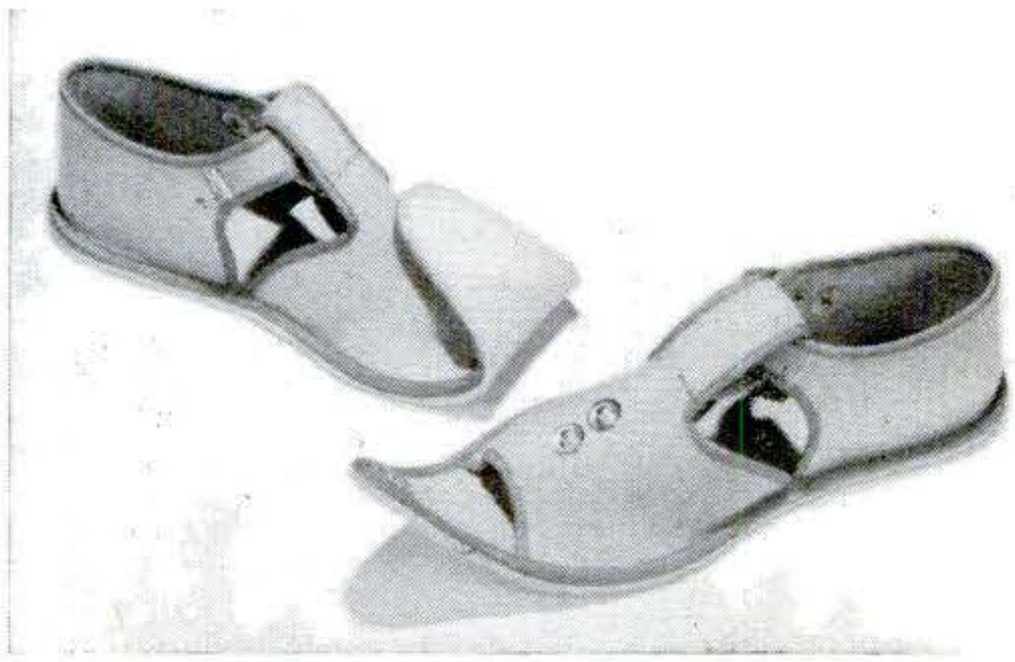
Waiter Waits Flat on His Back—His Suit Will Not Let Him Sink

THE "waiter" above is floating around a pool with his tray to demonstrate a fabric that admits air but repels water. The suit he is wearing is made of a tightly woven cotton (about 90 threads to the inch). The British fabric will be used for children's swim suits and play clothes by Jack Tar Togs of Baltimore.



Steps Keep Boat Close to Dock

THERE's less danger of rocking the boat and ending up in the drink when passengers embark from marine steps like these. When lowered, the stairway pins the boat to the dockside to hold it steady and to keep it from veering off, but a touch pivots the steps up out of the way when not in use. It bolts to the dock, can be adjusted for a six-inch rise in water level. The Ricpat Co., Minneapolis, makes the Dockmaster.



Sandals Expand with Your Feet

THESE rubber-soled denim sandals will never cramp your feet. Two snap buttons for the turn-up toes allow you to vary length and width a full size. The Blankiette Corp., 129 West 20th St., NYC, makes them.

Lock Makes Loaded Gun Safe

TEX BJORKLUND, a policeman and a family man, became an inventor because he didn't like having a loaded gun in the house. He worried at the problem until he came up with a trigger lock (left). Now the Bjorklund Mfg. Co., Santa Monica, Calif., is making the Revolock for standard revolvers.

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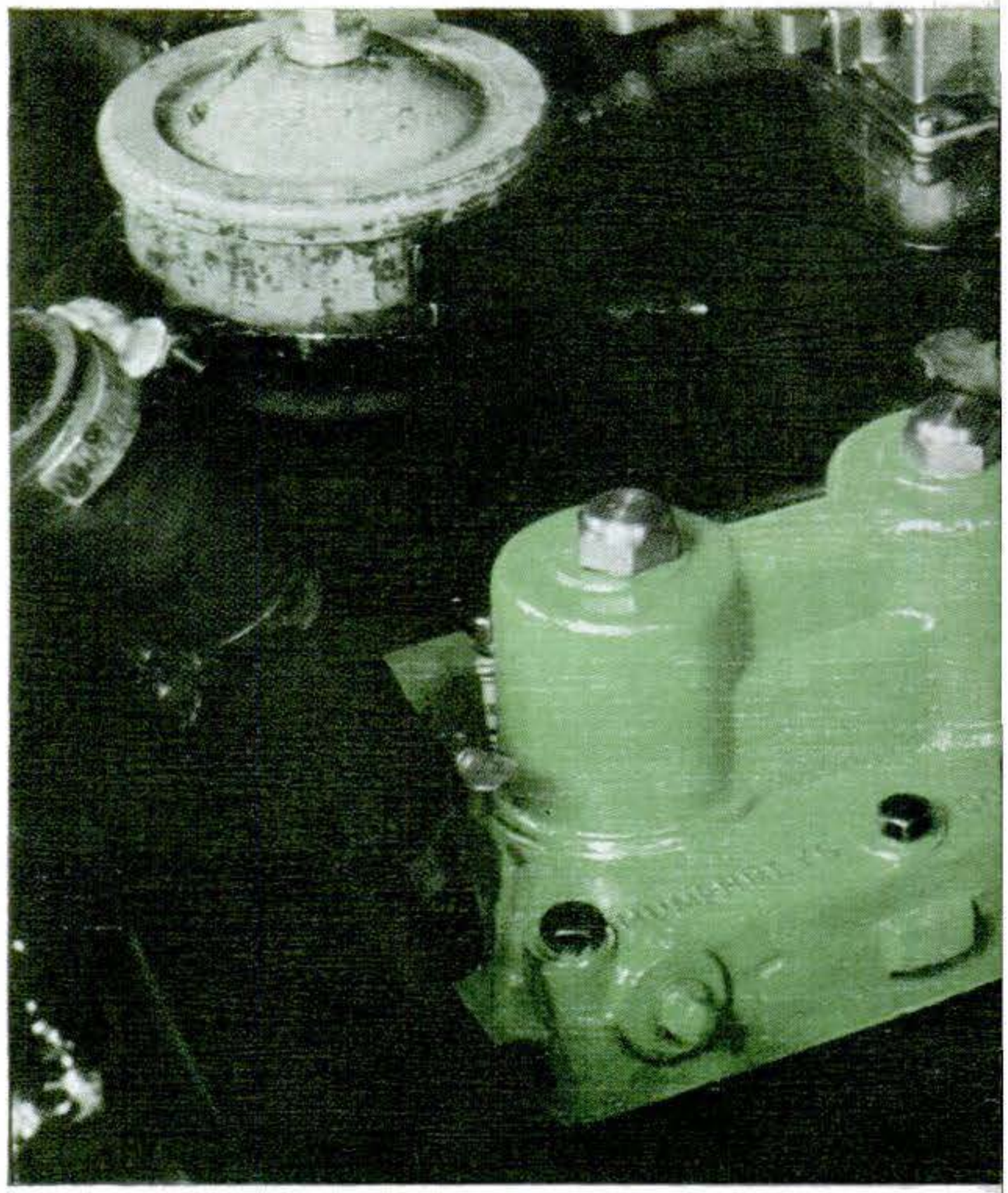
Extra Arm Holds the Phone

CUDDLING the phone to your ear with this Tenite brace leaves both hands free to take down messages. The shoulder piece is padded with foam rubber. *Rans Mfg. Co., New York City.*

Flutter Board Is All Plastic

THIS gal is riding a one-piece beach board made of smooth-surfaced vinyl resin plastic with a spongy core filled with millions of gas bubbles. *Sponge Rubber Products Co., Shelton, Conn.*



Denver inventor gets 30 miles a gallon at 40

Trick Engine

Midget auxiliary pistons vary

By Gene Lindberg

A MAN named I. B. Humphreys returned from a business trip of several hundred miles in his six-cylinder 1949 Oldsmobile the other day with a record of 24 miles to the gallon of gasoline at a highway cruising speed of 60 miles an hour.

Even at that, his gas mileage was low. He gets 30 miles to the gallon at 40 miles an hour; 36 miles to the gallon at 20 miles an hour. That is half again as much as an ordinary 1949 Olds will deliver. And he buys his fuel at any filling station.

Humphreys' car is no ordinary Olds. It's fitted with what he calls a con-

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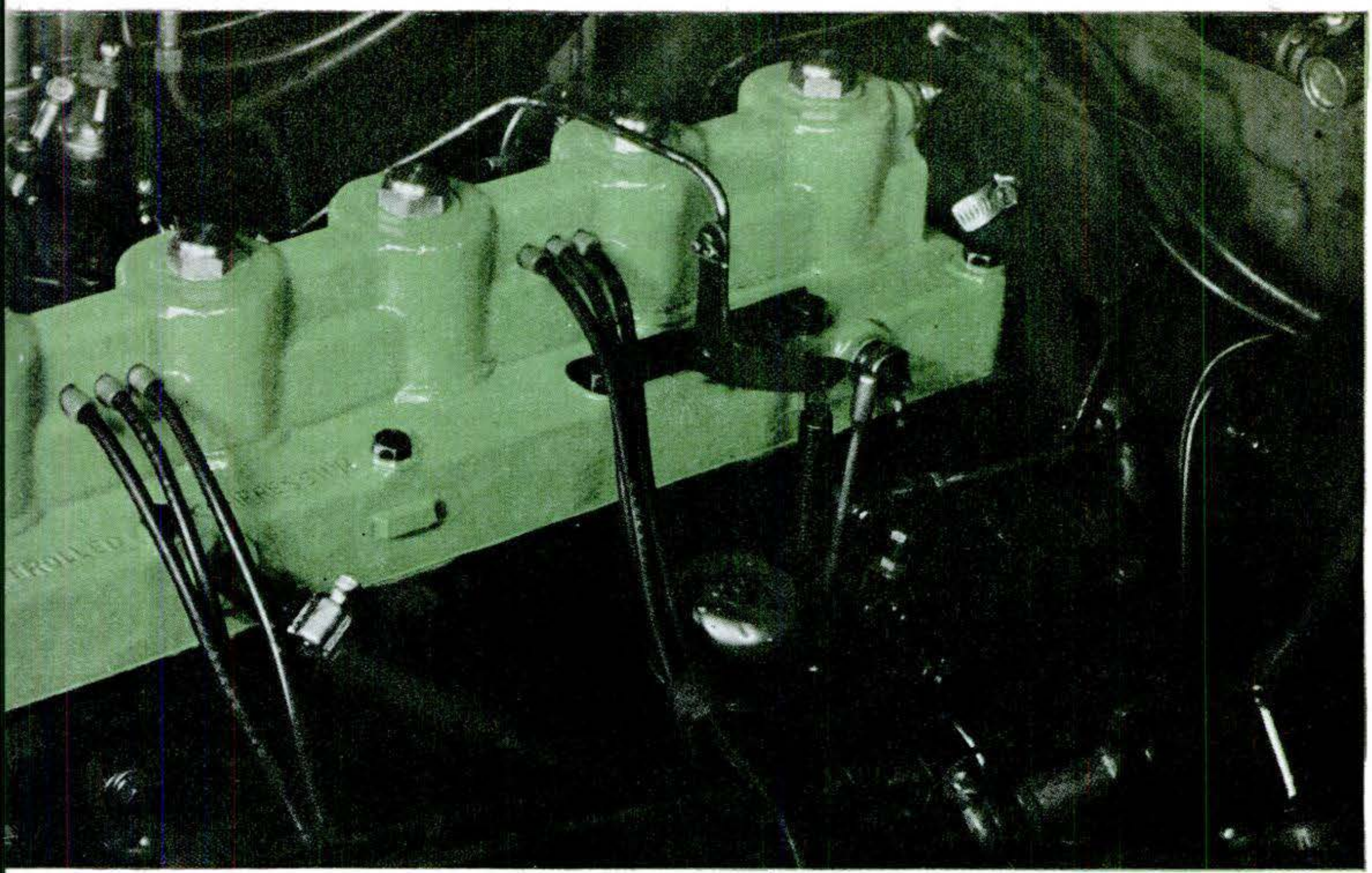

miles an hour with this special head permitting controlled compression on standard Olds.

Head Ups Gas Mileage 50%

the compression ratio automatically to suit the load and speed.

trolled-compression engine. Unlike other gasoline engines, its compression ratio —that is, the amount that its air/gas charge is squeezed on the compression stroke—varies all the way from 6½-to-1 to 14-to-1.

The engine basically is a standard Olds "76" L-head. Humphreys, inventor of a means of getting a wide range of compression ratios, modified it.

The engine changes compression automatically by varying the size of its combustion chambers. At light load and part throttle, the compression ratio shoots up. When the engine works hard and the throttle starts opening, the ratio drops. The ratio can bob up and down like the float on a fishing line because of a little auxiliary piston in the head of each cylinder. When the piston goes up, it increases the volume of the combustion chamber. When it goes down, it decreases it. It's that simple.

No Other Car Like It

Humphreys has the only automobile in the world that operates like this. When he rolled into his garage and switched off his ignition the other day, he completed almost three years and 50,000 miles of controlled-compression driving.

His engine is one answer to a fundamental fault of all internal-combustion engines. Ever since World War II ended, the automobile manufacturers have been

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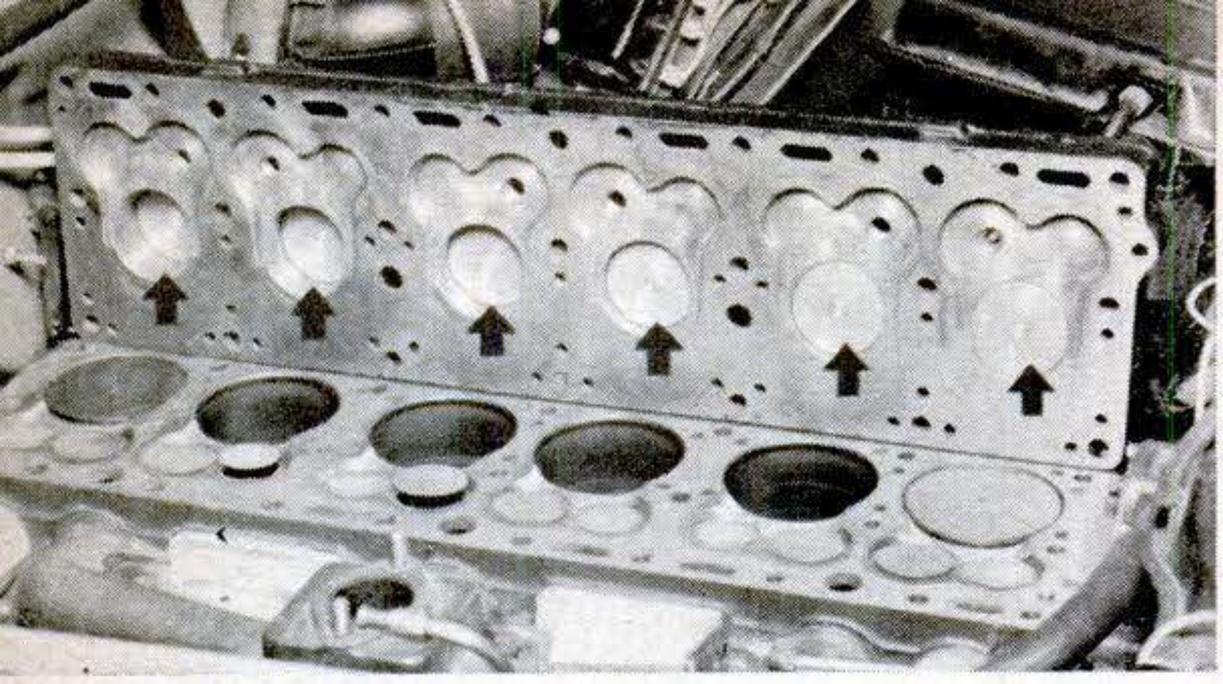


ENGINE HEAD opened shows positions of spring-control pistons (arrows) built on principle of hydraulic valve lifters. Oil pressure on them varies from 25 to 50 pounds.

boosting compression ratios to get better gas mileage. The higher the compression ratio, the better the fuel burns, the greater the amount of power delivered.

But the basic trouble remains. While the compression ratio remains the same, the *density* of the charge in the cylinders swings wildly from low to high and back again as pressure on the accelerator pedal changes. What is needed is an equal amount of squeeze—an equal amount of pressure per square inch—throughout the speed range.

But the amount of squeeze on the compression stroke is limited. When a car engine is working hard at low r.p.m.—when it's climbing a hill at low speed, for instance—it wants to "ping." The pressures in the cylinder heads build up. The fuel tends to explode instead of burning progressively. That wastes gas.

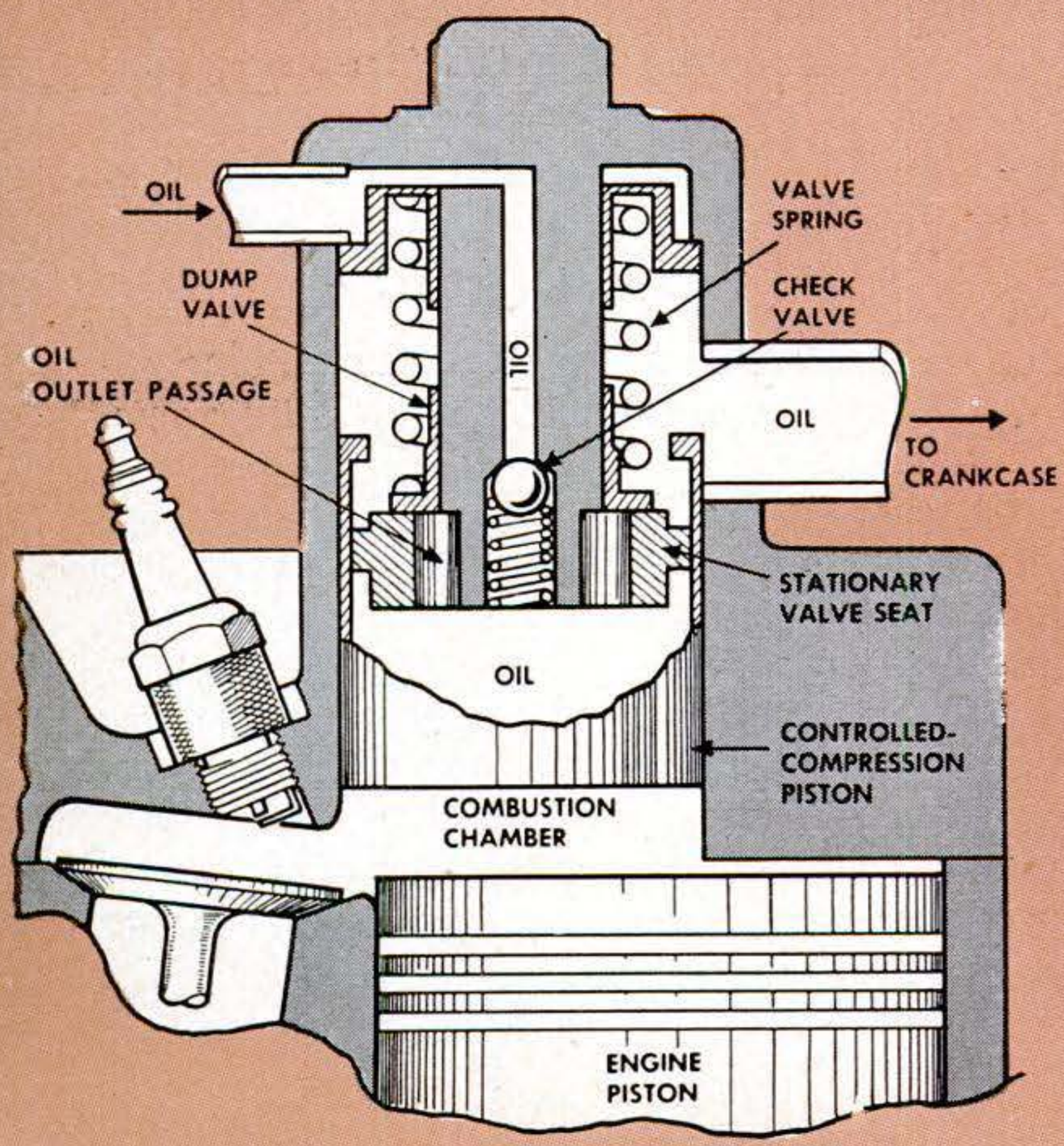
It's the necessity for preventing ping under heavy load and low r.p.m. that limits the compression ratio in fixed-compression engines. Yet any of today's engines could cruise happily, without pinging, at a ratio of 12-to-1 on ordinary gas under light load at high speed.

Fixed compressions result in poor gas mileage at light throttle. Denied the chance to put the squeeze on an air/gas charge that is only a fraction as dense as at full throttle, the engine extracts only a pittance of the power in the fuel.

Ever since the turn of the century engineers have resorted to sundry ways to make internal-combustion engines more responsive to load and throttle conditions without knocking. The Kettering high-compression engine (PSM, Oct. '51, p. 125), using fuel beyond 100-octane rating, is one of them.

Humphreys' modification doctors the ailments of the internal-combustion engine by tailoring the compression ratio to engine load and throttle setting. As the load drops and the speed goes up, the engine becomes progressively more capable of tolerating higher compressions.

W. H. Paul, professor of automotive



PRINCIPLE of controlled-compression engine is simple. Oil under engine pressure pushes down on little auxiliary piston in effort to reduce size of combustion chamber and raise compression. Combustion pressures try to push little piston up, decreasing compression. In actual practice, oil, retained by check valve, presses both on piston and a spring-loaded dump valve. When throttle is opened, combustion pressure rises, oil presses on and opens dump valve, oil is released, and piston goes up. When throttle is eased off, combustion pressure drops, dump valve closes and oil pressure again is built up on piston and valve to boost compression ratio.

Humphreys (far right) pauses with friends on Pikes Peak trip in controlled-compression car.

engineering at Oregon State College, has worked with Humphreys on the road tests. They report that the engine has been practically trouble-free throughout, and described it in a joint paper read before the Society of Automotive Engineers in 1951.

Critics Are Answered

The engine did not get off scot-free of criticism. Engineers from GM, Ford, the Shell Oil Co. and the Ethyl Corp., asked by Humphreys and Paul to comment, contended that the engine could not get as much gain in gas mileage from variable compression as they could get from raising fixed-compression ratios.

Humphreys, a businessman with extensive oil and mining interests, and Paul told their critics that their principle "is not a substitute for any feature of high fixed-compression ratio." But they remarked that fuels for engines with compressions of 12-to-1—like the GM experimental engine—would be years in coming.

In the two years intervening, Humphreys has made improvements on his engine. At full throttle he is getting 15 to 20 percent more horsepower than the standard 1949 Olds Six delivers on premium Ethyl gasoline.

Humphreys says his principle can be adapted with no great effort to any engine. "An automobile manufacturer," he states, "could convert his L-head engine production over to this design at less expense than it would cost him to convert to valve-in-head design."

The application to existing valve-in-head engines he terms "relatively simple." END

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Whirlibird Beats Its Wings Coaxially

WITH twin blades whirling at top speed, this new copter bores through space at 100 miles an hour. A 450-hp. air-cooled radial engine drives the coaxial rotor. Built by Gyrodyne for the Navy, the copter hauls a pilot, medical corpsman and three litter patients—or a pilot and six passengers—and fuel for three and a half hours of flight.

Airport Tug

COPTER tugs that would grapple airplanes to lift them into the air or to set them down within restricted areas have been proposed by Dr. J. A. J. Bennett of Hiller Helicopters.

Jet Windjammer

THREE jets—one at the tip of each blade—spin the French Ariel III on its way. Because the rotor is self-propelled, it develops no torque and no compensating windmill is needed at the tail to keep it from slewing around.

Aerial Convertible

THE French Farfadet takes off, lands or hovers like a helicopter, and flies with a fixed wing like a plane. A turbine spins the prop; tip jets turn the rotor.

Twin-Spin Amphibian

THIS Navy copter has two intermeshing rotors—like an egg beater—with control flaps on the blades. The Kaman HOK-1, it's a four-place job with air-cooled engine.

High-Tailing Copter

THIS Doman is first production copter with a single four-bladed rotor. A second rotor rides a high-angled tail that keep blades above head level on the ground.

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SEVEN PASSENGERS ride comfortably in this 1,795-pound German three-wheeler. Front-wheel drive pulls a 3,300-pound load.

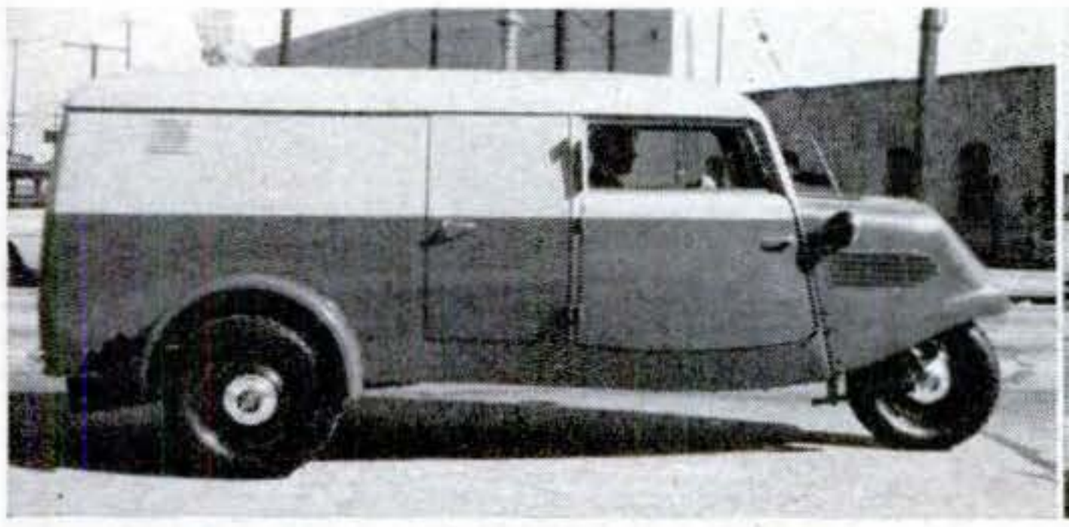
Here's a Tricycle Built for Seven

LOS ANGELEANS think their ears are playing tricks these days. They hear the put-put of a motorcycle but what their eyes see riding by is a full-size station wagon with seven passengers aboard. It's one of a trio of three-wheelers built by Hans Vidal and Sons of Hamburg, Germany, and imported by Fred J. Tabery, L.A. businessman.

Vidal developed the cars while experimenting with motorcycles. A two-cylinder, two-cycle engine drives each version through the front wheel. A chain carries the power. The engine, radiator and wheel turn as a unit when the steering wheel is flipped.

Frankly intended for the economy-minded, the Hanseats are touted to hit a top speed of 50 miles an hour on a 25:1 gas-oil fuel mixture. At lower speeds they can cover 35 miles to the gallon. Each model would sell for under $2,000 in the U. S. and a replacement engine would cost a measly $85.

RAISED HOOD SHOWS tiny water-cooled engine mounted on fork so it turns with the wheel. Wheel is sprung by independent twin-coil suspension combined with telescopic shocks.



PANEL TRUCK weighs in at 1,640 pounds. Like the other versions, it rides easy with dual-coil springs over each axle. Chassis is of distortion-free, central-tube design.

PICKUP TRUCK, lightest of trio, weighs only 1,440 pounds but can haul 1,500-pound pay load. Tabery says cars take curves and handle in traffic with stability of four-wheelers.

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Explorers' New Finds Tell of Monster

SIXTEEN INCHES LONG, this Great Cave Bear skull from an English cavern shows the size of the prehistoric monster's head.

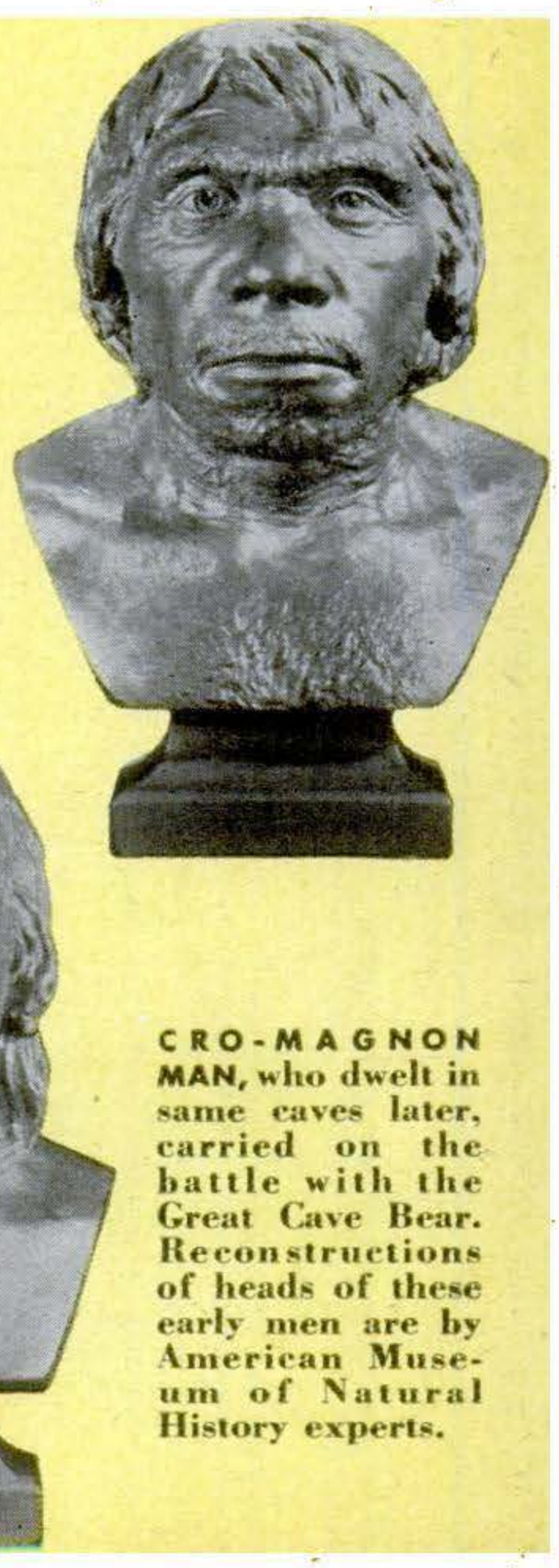
Dramatic story of how Stone Age men battled great beast is pieced together from clues in caverns.

By Alden P. Armagnac

BLASTING their way through centuries-old walls of living rock, delvers into the past are enriching our knowledge of a creature that has inspired tales of dragons. Their discoveries tell of life-and-death battles, by torchlight, between cave people and a gigantic beast of the Stone Age—the Great Cave Bear.

Newly opened caverns have lately yielded fresh trophies to be added to the growing lore of this nightmarish animal. Its skulls, bones and petrified footprints were found in the "Witch's Cave" near the Italian village of Toirano, when fossil hunters dynamited a six-foot-thick stalagmite that had barred the way to an unexplored gallery since the cave's discovery in 1880. Again its remains came to light, last year, in a previously unknown cave uncovered by blasting near Santander, Spain.

Beside the Great Cave Bear, today's ferocious grizzly bears would look like

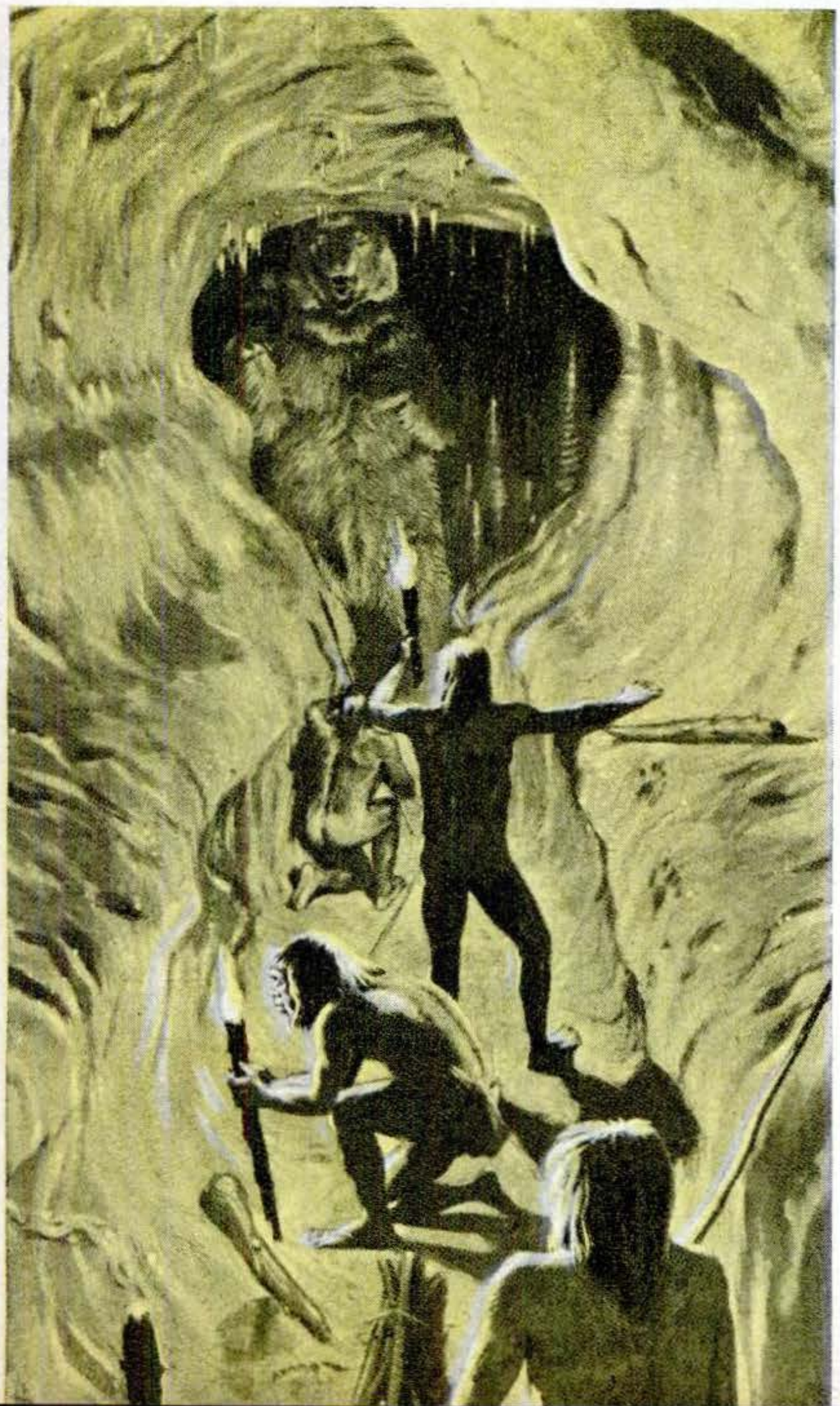


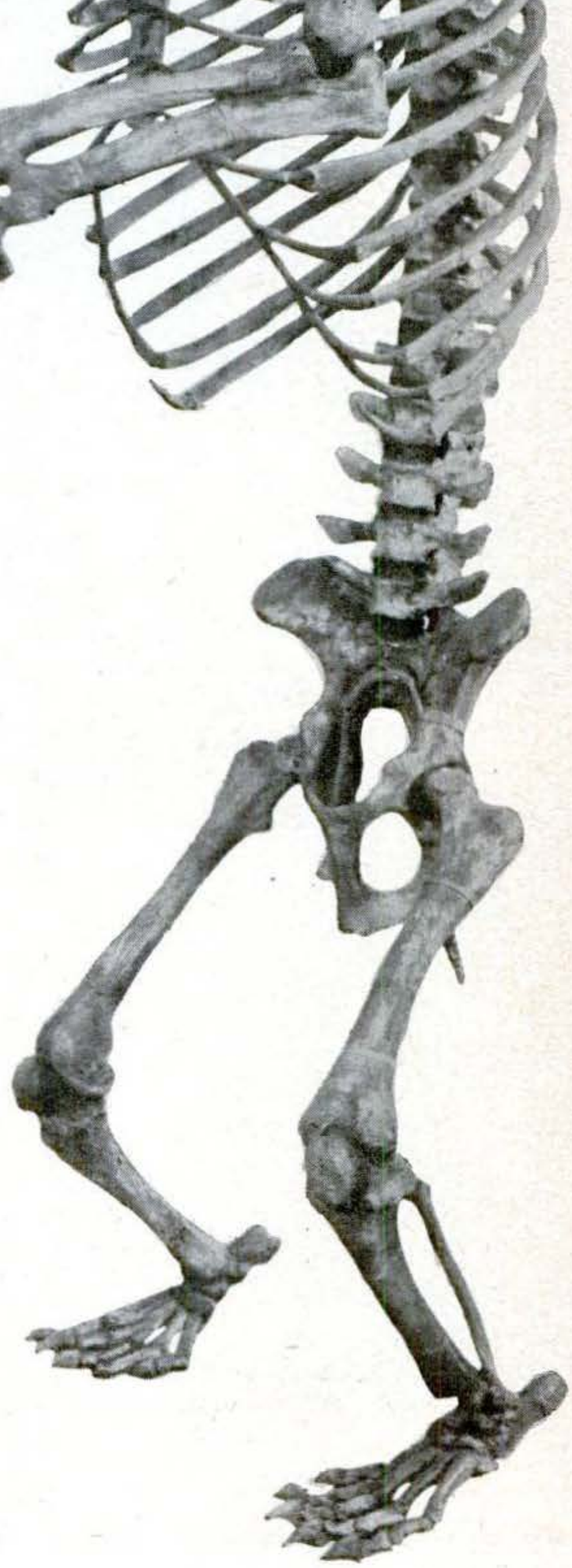
EARLY COMER who had to battle the Great Cave Bear for his home was this Neanderthal Man. Scene in cave as he confronts the fearsome beast, by light of his torches, is pictured on opposite page.

CRO-MAGNON MAN, who dwelt in same caves later, carried on the battle with the Great Cave Bear. Reconstructions of heads of these early men are by American Museum of Natural History experts.

STRIKING POSE of Great Cave Bear's skeleton—at American Museum of Natural History—shows how beast would face attackers, with teeth bared and claws outstretched. This specimen is from a Czech cave.

Cave Bear





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CAVE MEN, whose life centered near mouth of a cavern, sallied forth on hunts—and, as above, to repel animal invaders, likewise seeking refuge from bitter cold of that era.

dwarfs. Its most striking feature was its enormous head, as shown by the great size of the skull. Its forepaws likewise were enormous, and its body thickset and massive.

Although this prehistoric monster has seldom been mentioned in popular literature, discoveries of its bones have given rise to numerous descriptions of it in naturalists' writings.

What may be the first dates back to 1672. In that year J. Paterson Hayne studied some of the bones from a cave in Hungary, and solemnly published his conclusion that they were the bones of dragons. For half a century, that was accepted as fact.

The most recent study of the Great Cave Bear occupies more than 50 pages of a new two-volume work, *A Review of Fossil and Recent Bears of the Old World*, published this year by a Dutch naturalist, D. P. Erdbrink. A map he has compiled, from all the places where Great Cave Bear remains have been found, shows that the monster ranged over a large area of continental Europe and part of Great Britain, then joined to the continent by a land "bridge."

Seven feet from nose to stubby tail is the estimate given by Erdbrink for the size of one Great Cave Bear whose skeleton he measured.

Some naturalists have called this animal the biggest bear that ever lived, and a leading encyclopedia says so flatly. Other authorities dispute it. In one small part of the world, it turns out, there may be even bigger ones today—the Peninsular and Kodiak brown bears of Alaska, now known to reach a maximum length exceeding nine feet and a weight of more than 1,600 pounds. But all agree that, at the very least, the Great Cave Bear was a near rival in size to these.

Men Battled Monster Bears

Weapons and tools of cave people, found intermingled with the remains of the Great Cave Bear, show that they lived at the same time and in the same caves! That the men must have battled the beasts has been shown by circumstantial evidence aplenty. Then a one-chance-in-a-million find, such as scientists hope for only in their dreams, clinched it beyond all doubt. A cave near Trieste yielded a Great Cave Bear's fractured skull with a cave man's stone axe still embedded in it.

Here is an example of fact that rivals fiction. When cartoonists take liberties with facts by picturing cave men and dinosaurs in the same scene—actually, dinosaurs were extinct when men appeared on earth—they're overlooking exciting battles between men and monsters that *really* happened.

It was a time of far different climate from today's, this strange and long-drawn-out period in the dawn of mankind. Alternately Europe shivered and thawed, as four successive ice sheets buried its northern part and then re-

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treated. Besides the bears, its fauna at times included reindeer, elephants, rhinoceroses and mammoths.

Great Cave Bears, having roamed outdoors in milder months, retired to caves at winter's approach and hibernated in their comparative warmth.

Likewise seeking refuge from the bitter cold, Stone Age people set up housekeeping in the same inviting caves. Among the early comers was the extinct and "lowbrow" race we call Neanderthal Man, who lived during the period from 100,000 to about 20,000 years ago.

Picture a Neanderthal family as night falls, huddled about their fireplace within the cave's mouth for warmth, with the fitful flames casting grotesque shadows over the moisture-dripping limestone walls. The fire dies to embers, the gloom deepens. And then they see, peering at them out of the blackness, the glowing eyes of the great beasts!

Men or animals had to go—and, standing their ground, the cave people girded for a war to the finish. Soot-filmed walls of some of these caves reveal their principal tactic. They smoked out the monster bears. As proof of the soot layers' date, they bear the imprint of actual claw marks of the bears, perhaps made as the animals tried to escape. For as the bears lumbered from their hiding places—probably groggy from the fumes, but still formidable—the cave men set upon them with flint spears and axes.

Death-on-the-Left Mystery Solved

Sometimes a cave's natural layout lent itself to stratagem. A puzzle at first, to explorers of the Dragon's Cave near Mixnitz, Austria, was discovery of a great many cave-bear skulls that had all been fractured on the left side! Then they found a place in the cave, marked by two Neanderthal fireplaces, that was ideal for an ambush. A cave man concealed there could club an animal coming out of a narrow passage from the cave's innermost part. The blow would strike an emerging beast from its left side —and the riddle was solved.

Whatever the casualties among the Neanderthal bear-fighters, they won. As experts sift successively later cave deposits, cave-bear bones continue to be found, but Neanderthal tools and weapons show the cave men securely in possession.

And then Stone Age events take a

Picturing animals on cave walls was probably a Stone Age rite to assure good hunting.

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strange turn. Neanderthal Man vanishes without a trace!

The curtain has fallen upon his prehistoric drama. When it rises again, upon another, a superior new kind of cave man has inherited the warfare with the Great Cave Bears.

The newcomer upon the scene is our own ancestor, Homo sapiens. He first appears about 20,000 or 25,000 years ago. Intelligent, handsome, amazingly modern-looking is his outstanding representative, known as Cro-Magnon Man.

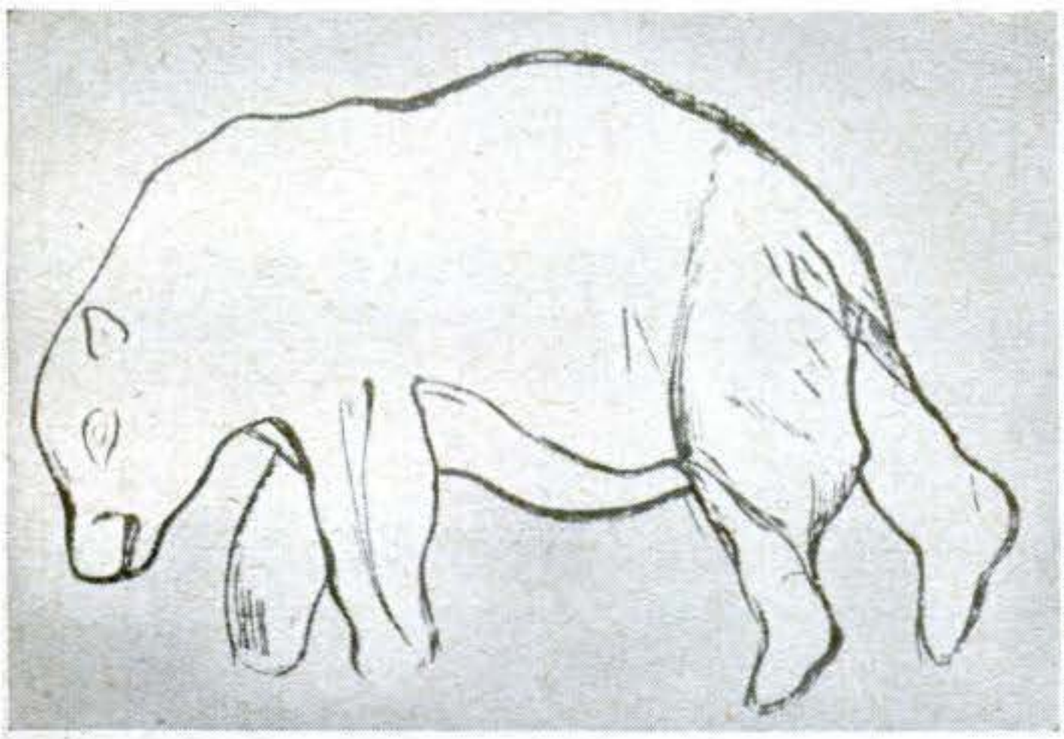
Did he exterminate Neanderthal Man —or drive him off to some unknown exile? What happened remains veiled in mystery. All we know is this: Cro-Magnon Man took over the abodes of his predecessor so suddenly that deposits in 18 European caves show no discernible lapse of time between occupancies.

Now the odds against the Great Cave Bear became more one-sided. Cro-Magnon hunters had advanced weapons for their times, possibly even including the bow and arrow, and could cope with it more effectively. But it is clear that they did not immediately hunt it to extinction, for the bones of the Great Cave Bear continue to be found for a considerable period; perhaps other factors such as changing climate had more to do with its ultimate end.

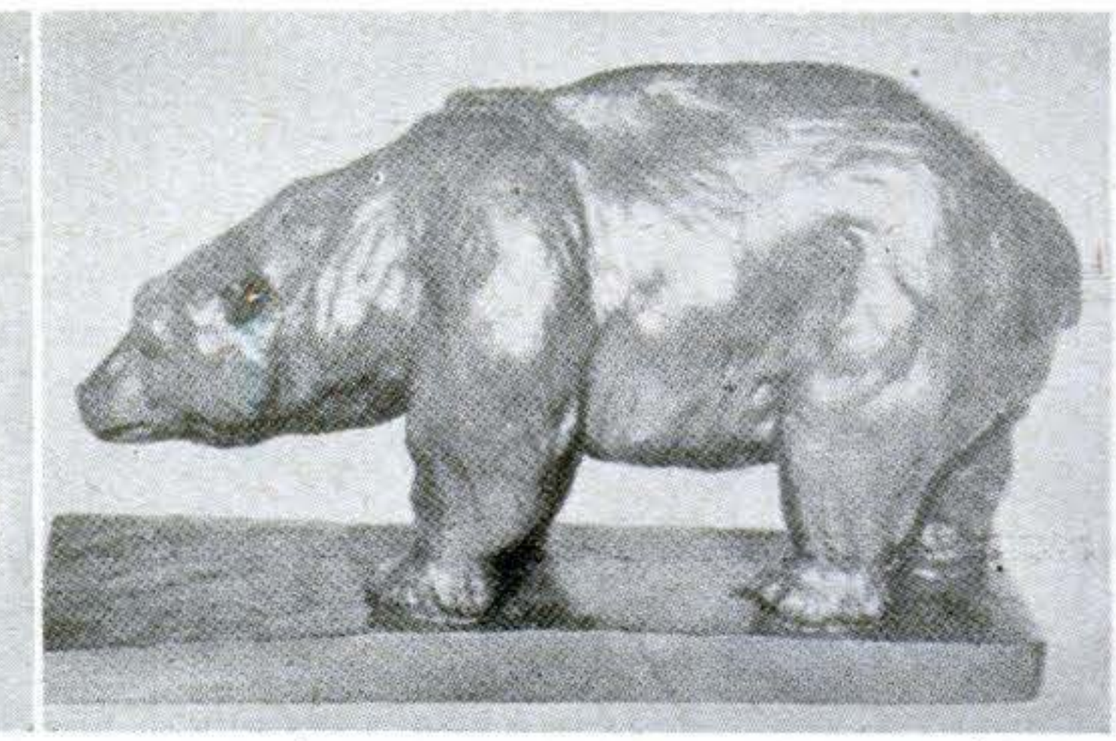
Last Men to See Bear Alive

Last of Stone Age men to see the Great Cave Bear alive, these primitive but talented people preserved for us their impressions of what it looked like. Along

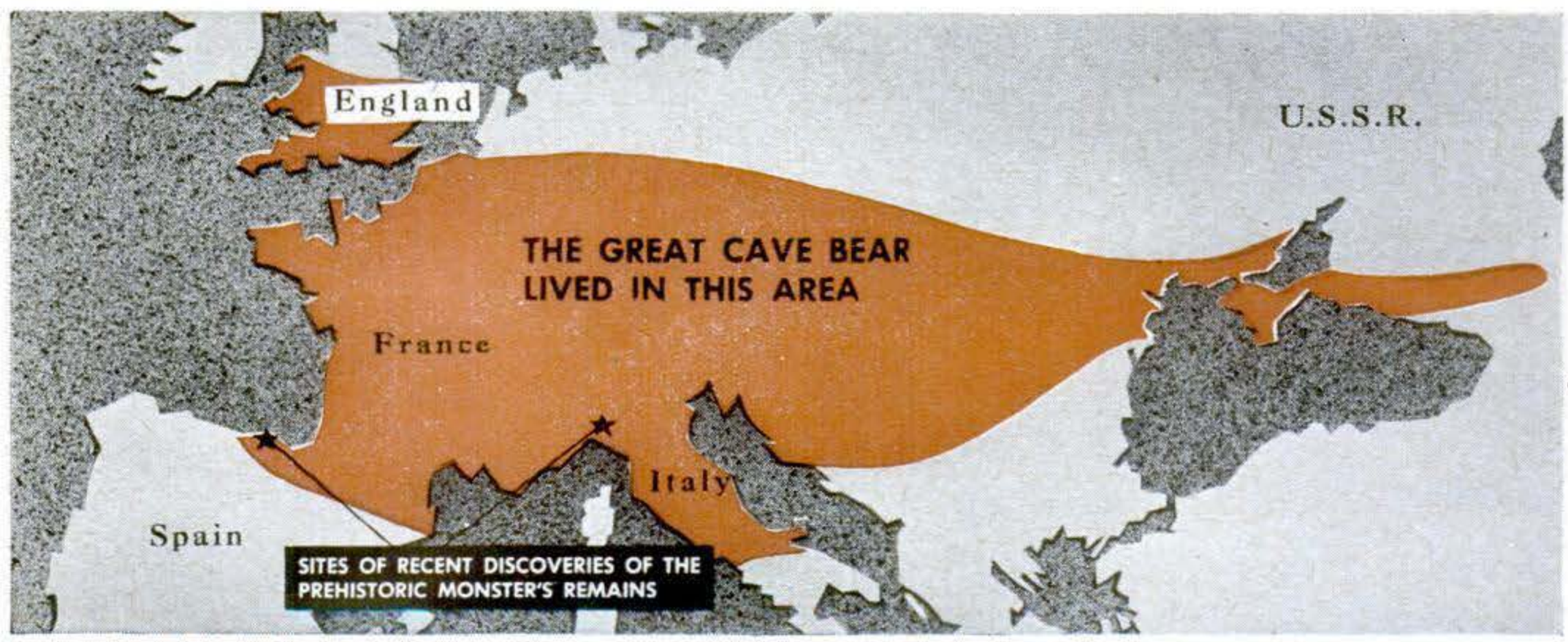
[Continued on page 214]



PREHISTORIC PICTURE, believed an accurate likeness of the Great Cave Bear by a Stone Age artist who actually saw it, was found carved on wall of cave at Dordogne, France.



MODERN RECONSTRUCTION in plastic of Great Cave Bear, based on best available scientific data from every source, shows striking resemblance of earliest and latest conceptions.



WHERE GREAT CAVE BEAR LIVED is shown by shading on map, adapted from recent one by D. P. Erdbrink, Dutch naturalist. Stars mark sites of two recent finds described in text.

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BIGGEST LIVING BEARS and Great Cave Bear's (above) and related Peninsular Bear, of only known rivals in size are Kodiak Bear small, remote part of Alaska (inset map).

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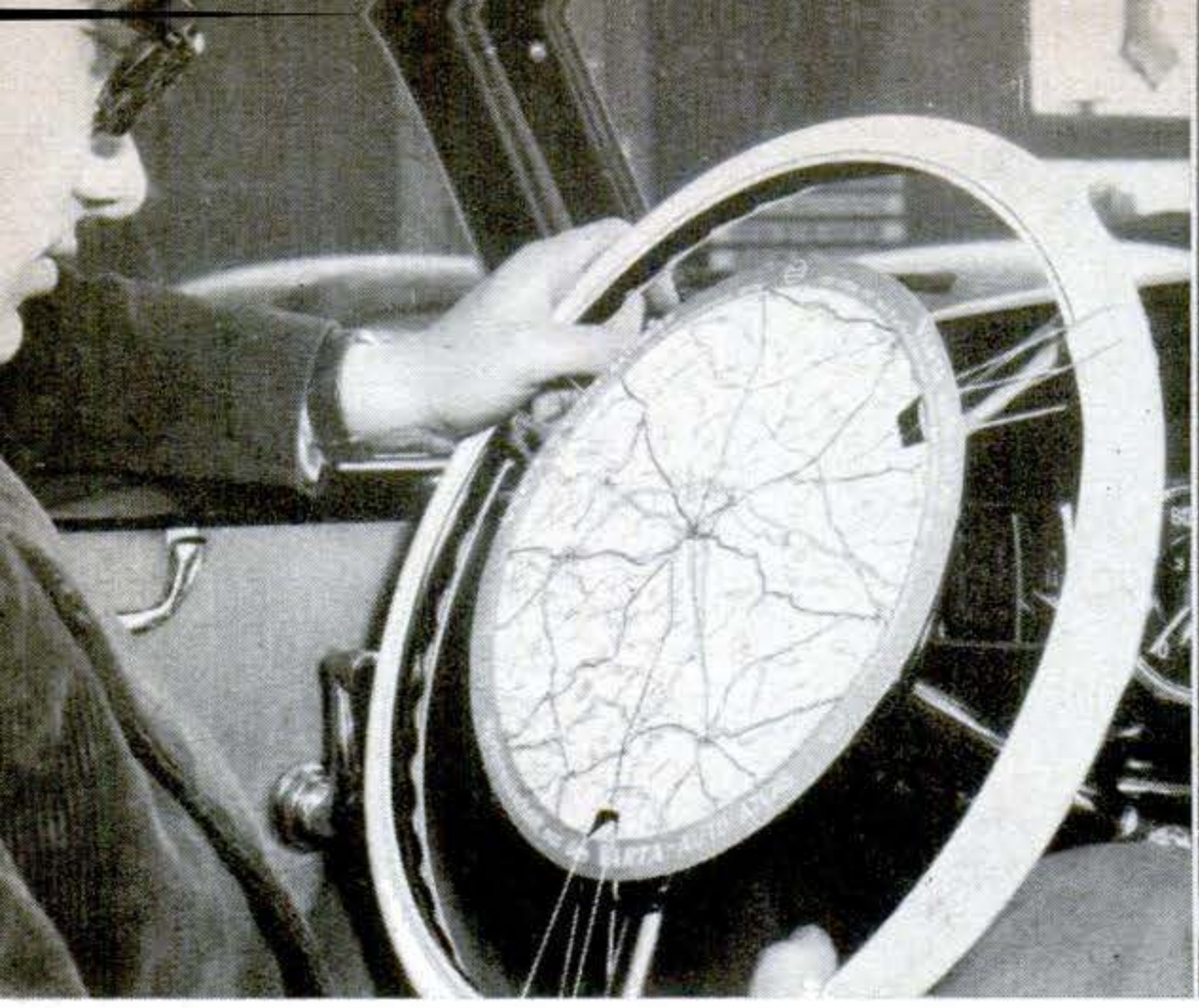

New Inventions Put Map on the Car and Plane on the Map

TRAVELING along the highway in a car or streaking through space in a plane, you know where you're at with two new aids to navigation. A circular road map that fits the steering wheel (upper left) has been devised in Germany to give the lone autoist a break. It will be printed in sets to cover a whole country.

The Pictorial Computer (above right), made by Arma Corp. of Brooklyn, N. Y., shows a plane pilot his position continuously. Here's how it works:

During the flight, a map centered on the nearest radio-direction station is projected from film strip onto a TV-like screen. A tiny airplane shadow image moves across this map, showing the pilot just where he is and where he's heading at any moment. The plane image is moved by a computer, which is fed signals from two radio receivers, one reporting the distance to the radio station, the other its direction. When the plane flies off a map, the pilot flips a switch to project the next section.

Tommy Wears an Ack-Pack

WHAT looks like a sombrero strapped to the back of the soldier above is the fuel tank of a powerful British flame thrower. The new weapon, called an Ack-Pack, was revealed at a Royal Army show staged for visiting members of the European Defense Committee.

Flying Suspenders Brace Pilot

LOW-FLYING pilots are now wearing safety belts with shoulder braces. The straps, fixed to a reel in the cockpit, allow the pilot plenty of reach. But if the plane decelerates as it would in a crash, the reel automatically winds in the straps and anchors them, pinning the pilot to his seat.

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Now—Powdered Vinegar

THAT spoonful of powder above will make eight ounces of vinegar when stirred into a glass of water. Now under test by the Quartermaster Corps Food and Container Institute in Chicago, the dehydrated vinegar acid is said to take only one-tenth the shipping space that is required for vinegar in liquid form.

Bike Rider's Legs Get a Rest

WITH this bike you can stop pedaling to give your weary legs a break and cut in arm power to keep you rolling. Pumping away at the handle bars drives the wheel, too. Both methods of locomotion can be used at once to squeeze more speed from the bike or to move it uphill with less effort. The bike was shown in Paris.

They Say Now.....

"Our food supply would be doubled, if all farmers did as well as the top 10 percent. It would rise 30 percent —enough to wipe out the present food deficit—if we but eliminated the losses caused by preventable pests."—DR. K. STARR CHESTER, BATTELLE MEMORIAL INSTITUTE.

"I have not had a really challenging student in the last three years, and lay this to upsetting conditions brought about by the Korean War." —DR. JOHN XAN, HEAD OF THE CHEMISTRY DEPT., HOWARD COLLEGE, BIRMINGHAM, ALA.

"At first it was a little embarrassing to be completely surrounded by about 30 naked men, women and children, each of whom insisted upon opening our shirt fronts, putting their hands in our pockets, pulling out and examining each item, pulling up our trousers to feel the hair on our legs, or repeatedly untying and tying our shoelaces.

"After trying on my glasses and my sun helmet, one Indian put his fingers to my mouth, wanting to know whether I could pull my teeth out."—DR. KALERVO OBERG, ANTHROPOLOGIST, REPORTING ON A SMITHSONIAN EXPEDITION TO THE BRAZILIAN JUNGLES.

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THE WINNER BY TWO MILES, Paul Goldsmith streaks across the finish line at Daytona Beach last March. He won A.M.A. 200-mile classic in fastest average time on record.

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He's the "Golden Boy" of Motorcycle Racing

New speed champion of the two-wheelers tells how he sets records and piles up prize money.

By Martin L. Lovelander

IN A blazing race on the pavement-like sand of Daytona Beach last March, Paul Goldsmith, a lean, blue-eyed six-footer from St. Clair Shores, Mich., won motorcycling's top speed contest in the fastest time ever recorded. Goldsmith, a quiet, extremely modest 28-year-old, traveled 200 miles around the 4.2-mile championship course at an average speed of 94.45 miles an hour.

"On the straightaways," he says, "they tell me I was doing 133."

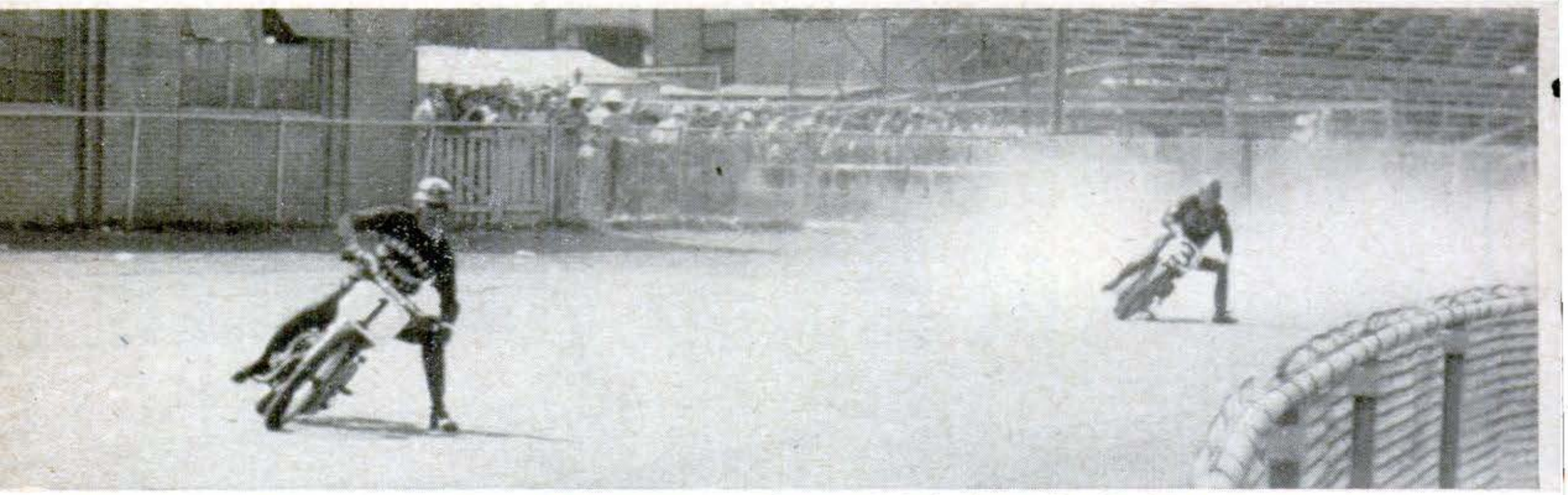
First home out of a field that at the start had included 111 of the best riders among the American Motorcycle Association's 100,000 members, he won himself a tall, golden trophy and $2,500 in cash. By fall, at the rate he has been copping prize money in other bigtime motorcycle races all over the country and practically every weekend, Goldsmith will have added two or three times that amount to his total pot for the season.

Married 10 years and part owner of a service station in Royal Oak, Mich., Goldsmith has none of the flamboyance you might expect of a champion jockey of the two-wheelers. He loves to tinker with and tune an engine till it whispers, and he revels in the roaring excitement of a race, but there's not an ounce of bluster or vanity in his make-up.

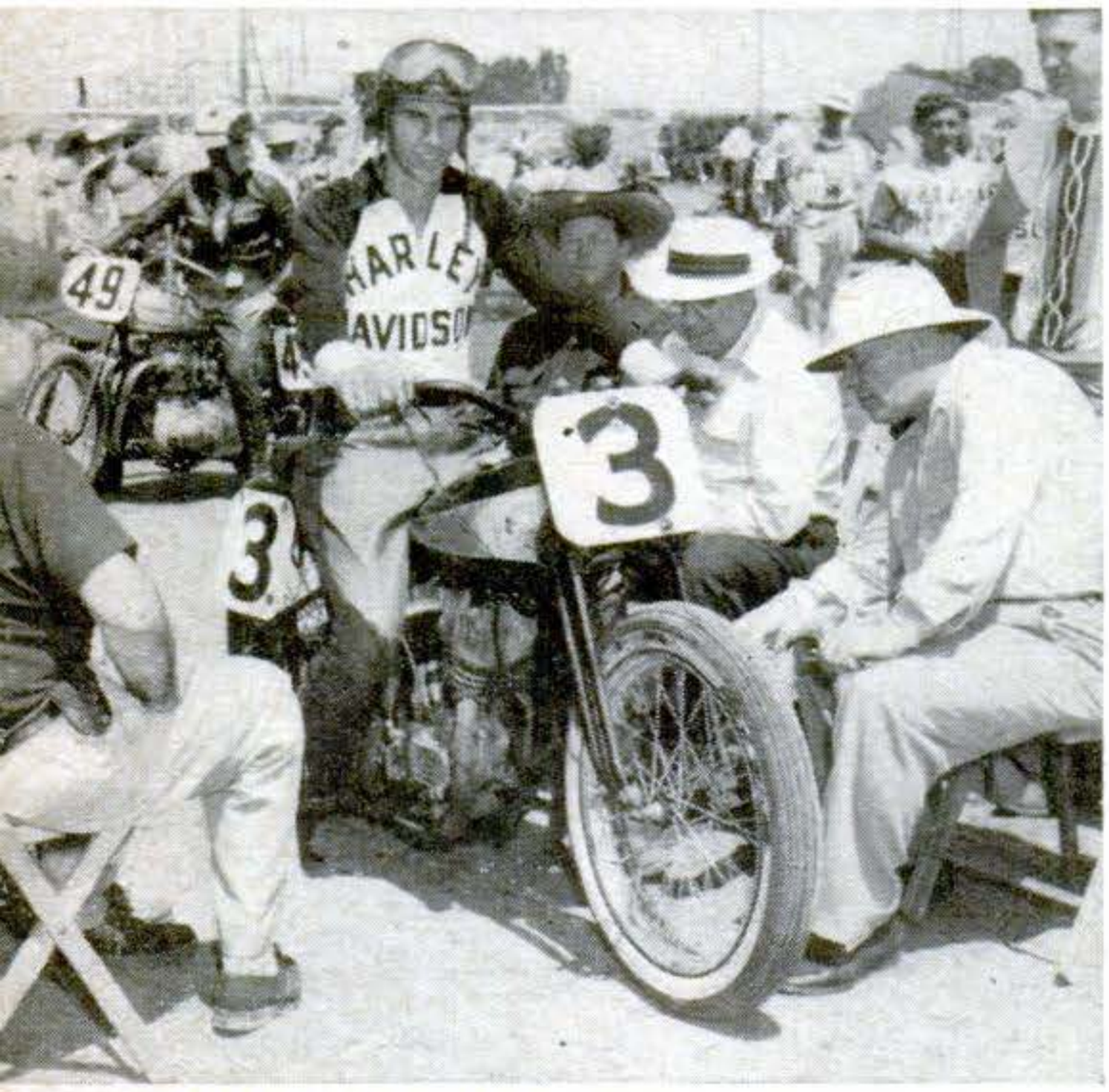
"Paul's as crafty as a scientific boxer," says an old friend who has doggedly competed with him many times. "If you happen to get out in front, you always know he's close to you, just waiting for you to make a mistake in judgment. And when you do—bingo, brother, there goes your win!"

Even the first time Goldsmith ever rode a motorcycle in a race, he took third place. That was in 1946 at Partington Pastures, outside Detroit—a flat dirt race track on which the competing

THE "GOLDEN BOY" IS OUT IN FRONT, streaking far ahead of the field on a typical dirt track, with unbanked turns. The race has just begun, for the "groove" has not yet been worn.



"BROAD SLIDING" AROUND A TURN consists of braking and balancing by dragging steel-slippered left foot. Looks like an awkward position of rest but was done at 65 m.p.h.



LOOKING FOR ILLEGALITIES, such as nonstandard parts, altered bore and stroke, compression ratio above 8:1, A.M.A. Technical Committee checks over Goldsmith's bike.

bike riders always dispense with brakes.

"There's a good reason for that," Goldsmith remarked soberly. "All the guys ride so close together that if anybody applied brakes, the whole crowd would probably pile up in a heap."

Lack of brakes didn't fluster him, nor did the fact that he was on a spare bike of a kind that he had never ridden before. He had come to watch, but somebody invited him to ride, so he rode. And nearly won.

That did it. Nearly every weekend of the spring, summer and fall of most of the seven years since then, Goldsmith has competed in county fairs, charity meets, club contests and A.M.A. championship races. There are 14 of the latter each year. They vary in distance from five to 200 miles, on tracks from half a mile to 4.2 miles long. They are usually scheduled for weekends or holidays, in widely scattered parts of the country. This year they are being run in Ohio, California, New Hampshire, Kansas, South Dakota, Wisconsin, Pennsylvania, Michigan, Louisiana and, naturally, Florida.

Covers the Country

Goldsmith, present national champion in the 15-mile A.M.A. race as well as the 200-mile, earns from $5,000 to $8,000 in prize money a season. The season, with the exception of the big event at Daytona Beach, extends from April to late October. He has flown to California contests, but usually he and his mechanic and another friend or two ride to the meets in an automobile, his motorcycle jouncing along behind on a small trailer.

This sometimes means driving as much as 1,700 miles in a weekend. But Goldsmith doesn't mind this, as long as he gets a good night's sleep before a race. And neither does his small, brunette wife, Helen, who generally goes along to watch and worry, as any loving wife might well do.

Goldsmith rarely worries about a race very far in advance, but on the day it is scheduled to be run, he declares he gets mighty nervous. Not enough so to cause him to lose his appetite for break-

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fast, as many of his competitors do, but still plenty uneasy.

He has one wise formula for calming himself down and at the same time shrewdly improving his chances of winning. For about 20 minutes or half an hour before a race starts, he walks around the course, carefully studying the condition of the track, pacing off the straightaways, looking for tacky spots on the turns, and estimating where the "groove" will form. The groove is not a narrow rut, as you might think, but the smooth, fairly broad path that many furiously spinning wheels quickly clear in the loose dirt of the track.

This hard, clean-swept surface rapidly becomes sticky with torn-off tread and provides splendid traction. Every racer tries to stay in the groove as much as possible, for there is grave danger of spills and certain loss of speed in the crumbly soil on either side of it. But sometimes a lingering dampness from a recent rainstorm will have left a streak just to the inside of the groove in a tacky condition. Goldsmith keeps a sharp lookout for those spots and tucks the knowledge of their location away in his mind.

Races Won by Inches

By veering a few inches away from the groove at such a place, he has learned that he can gain just enough extra traction to forge ahead of his nearest contender and perhaps even ahead of the field. After all, many motorcycle races are won by a matter of a few inches' headway.

Before each race in which he is entered, Goldsmith has additional time to study and make allowances for the changing condition of the track as the preliminary novice and amateur heats are run off.

This clinical knowledge of the course he is going to run not only gives him a frequent advantage coming out of turns but enables him to decide what gear ratio will give him the most for his power, considering the state of the track.

On his new, 350-pound Harley-Davidson KRTT, on which he won the Daytona Beach classic, he has a choice of 76 gear ratios, according to the various sizes and combinations of rear-wheel and motor sprockets he puts on. Sometimes he makes a change just before his race starts—not too difficult to do, for the whole job takes an experienced man only five minutes. He can obtain further variation in gear ratio by using tires of different sizes, and alter their traction by the amount he inflates them.

"Once the race begins, I'm too busy to be nervous about how it's going to end," Goldsmith says.

Keeps in Shape

That is easy to understand. There is little urge to ponder the outcome when your fellow riders are so close that their front wheels often gnaw at your leather-shod left leg and wear the paint off the number plate under your seat.

Goldsmith doesn't smoke or drink. He gets a lot of sleep. He passes up desserts, holding his weight to a lithe 145 pounds. He keeps his hands, arms and legs in the steely shape motorcycle rac-

[Continued on page 216]

TO THE GRINNING VICTOR at Daytona went a big hug from his wife, a tall trophy and $2,500. Goldsmith rode a four-speed Harley-Davidson with a foot shift and hand clutch.

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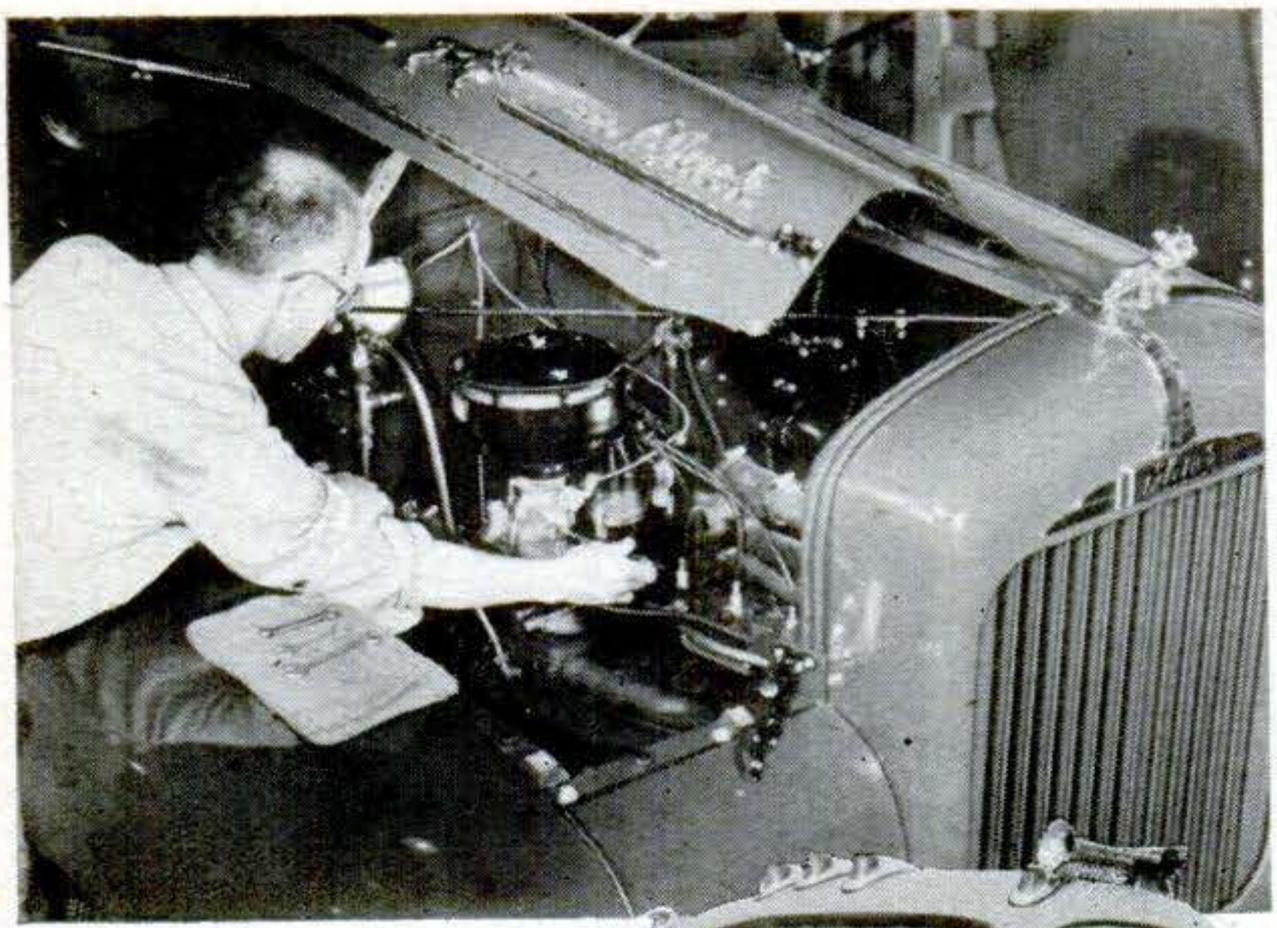
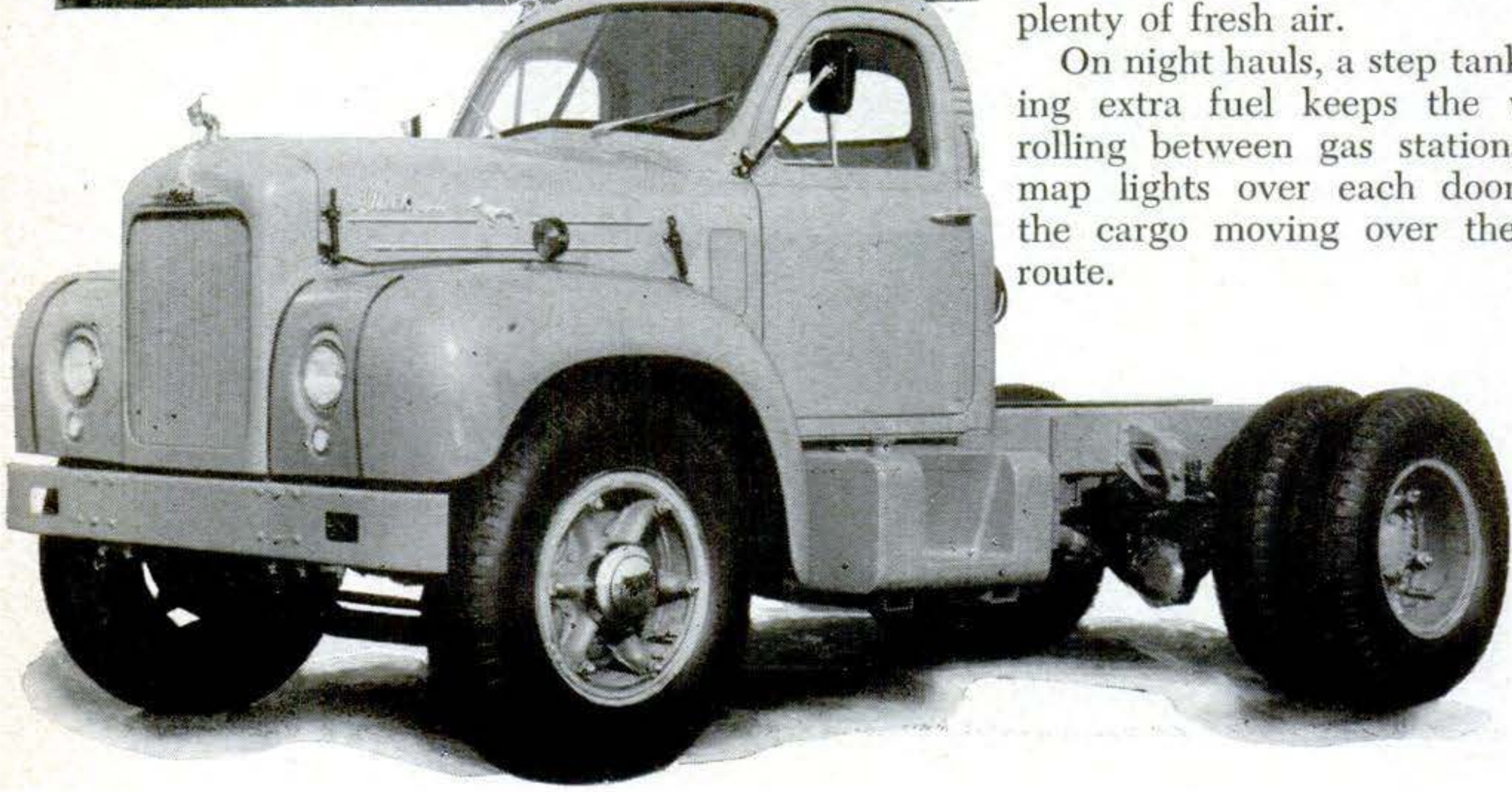


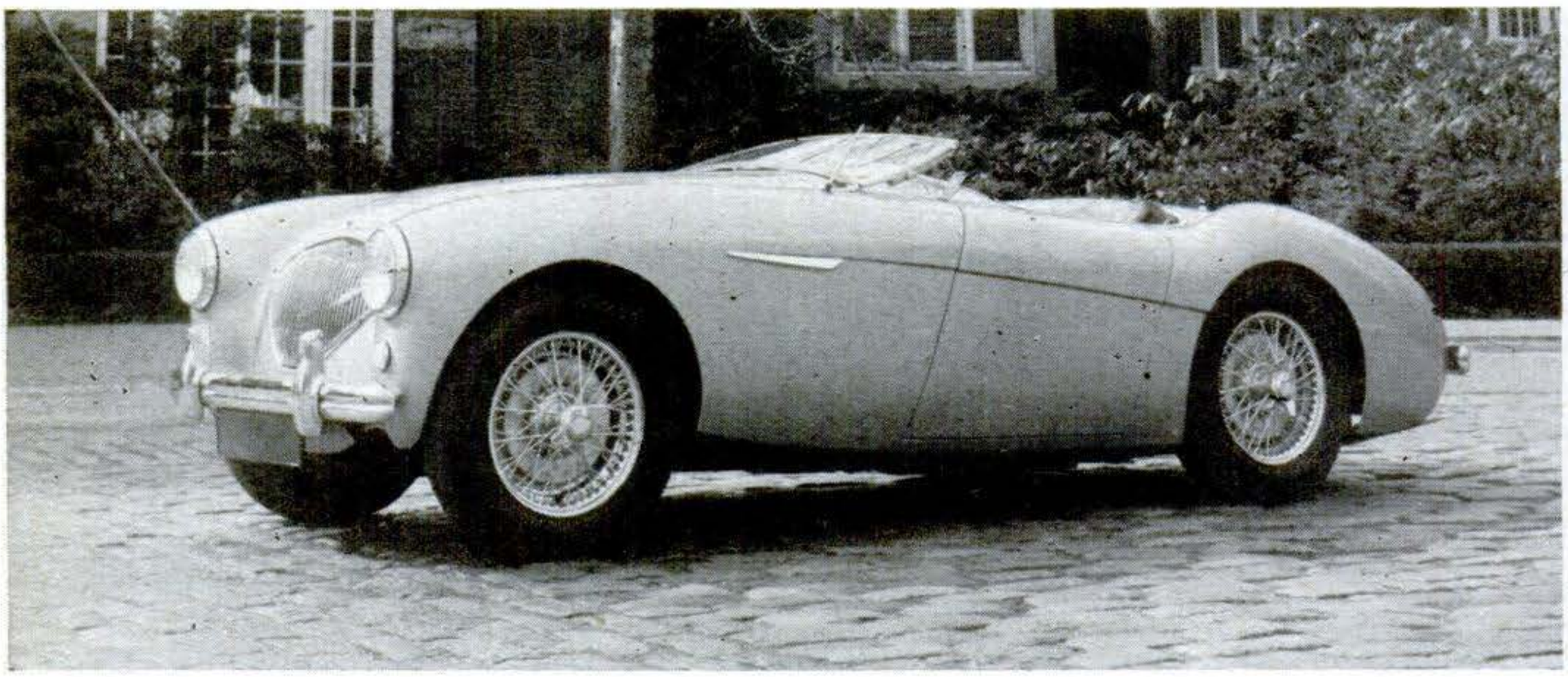
New Truck Eases Serviceman's Job

TROUBLE shooting is simplified on this new Mack truck. Lifting the hood (left) lays bare the entire top of the gasoline or diesel engine. Detachable panels completely expose the sides of the engine right down to the crankcase.

Driving the truck is no tougher than handling a sedan. The foam-rubber, coil-spring seat is divided, with the driver's section adjustable. The angled windshield cuts glare, and window and cab vents let in plenty of fresh air.

On night hauls, a step tank holding extra fuel keeps the wheels rolling between gas stations, and map lights over each door keep the cargo moving over the right route.





British Sports Car Gives High Horsepower Per Pound

THIS Austin Healey Hundred was designed for Americans. Driven by a 90-horsepower engine, its 1,900 pounds zoom by at 110 miles an hour, or leap from curbside to 60 miles an hour in 11 seconds. The windshield lowers to form a streamlining "scuttle" at high speeds. It will sell for about $3,000, plus shipping costs from U. S. port of entry.

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Mink Thrives on Vitamins

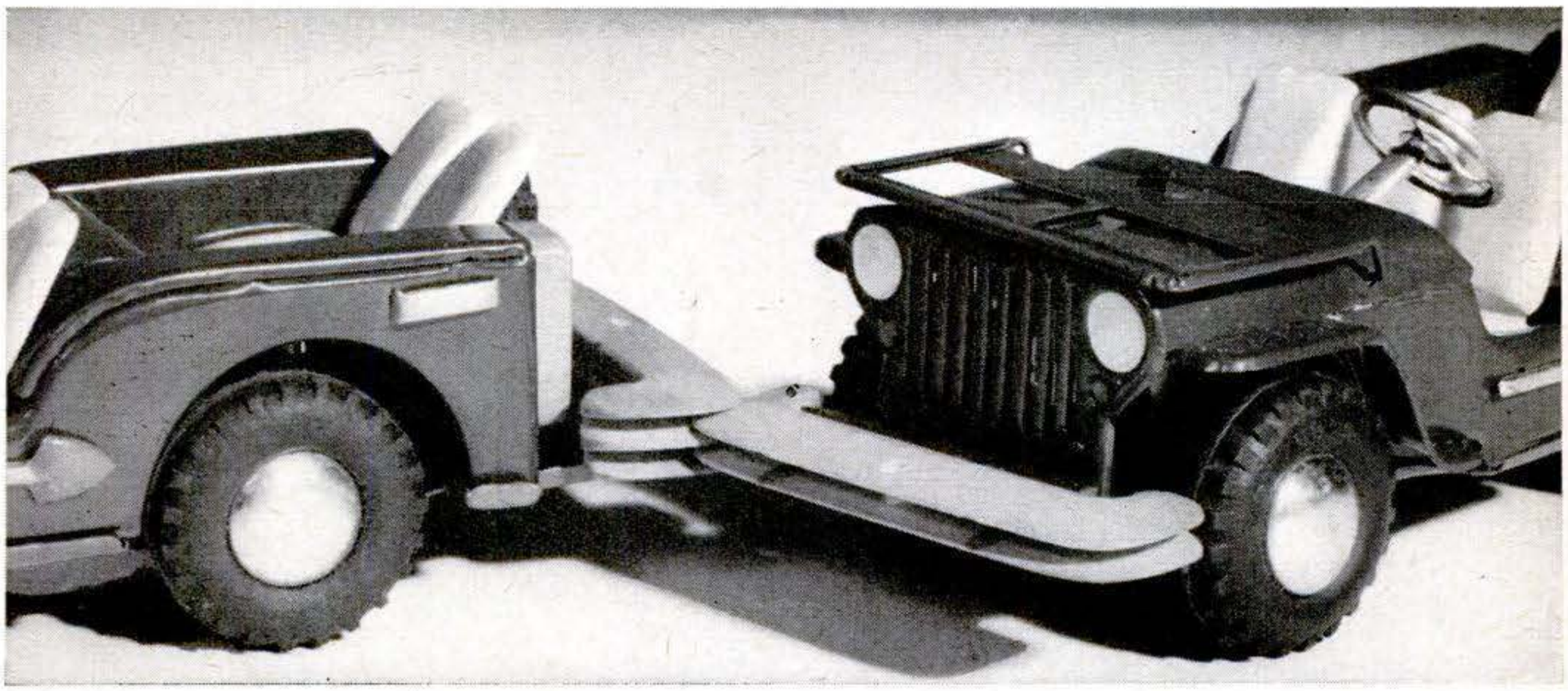
THIS time the mink is being investigated—by the University of Wisconsin's Biochemistry Department. Although it takes thick canvas gloves to handle them safely, scrappy minks are delicate and hard to raise. Wisconsin studies show that a diet fortified with milk and raw liver makes for larger and hardier specimens, improves the quality of pelts.

Swivel Base for Serving Tray

SUCTION grips on this maple-finished Serv-Mobile hold any tray above it firmly, to make a handy lazy susan. Four-and-one-quarter-inch, rotating base costs $1.49, is sold by Mrs. Dorothy Damar, 999 Damar Bldg., Newark 2, N. J.

Light Horse Keeping

SHOULDER-SLUNG vacuum cleaner which dusts off dobbin and leaves his coat as shiny as a newly waxed floor, was demonstrated at the recent Technical Fair in Hannover, Germany. Manufacturer Siemens says it's an indispensable grooming aid for all domestic animals, and offers this A.C.-D.C.-motored model for about 200 marks ($48).



Pleated Bumpers Save Pleated Fenders; Can't Interlock

CORRUGATED safety bumpers which can't interlock in a collision, are urged as universal car equipment by their inventor, Charles F. Martinetz. Two or more impact bars eliminate need for uprights, and deep, fluted construction produces high impact strength. Hole at center gives sturdy support for a towing pin, or trailer coupling.

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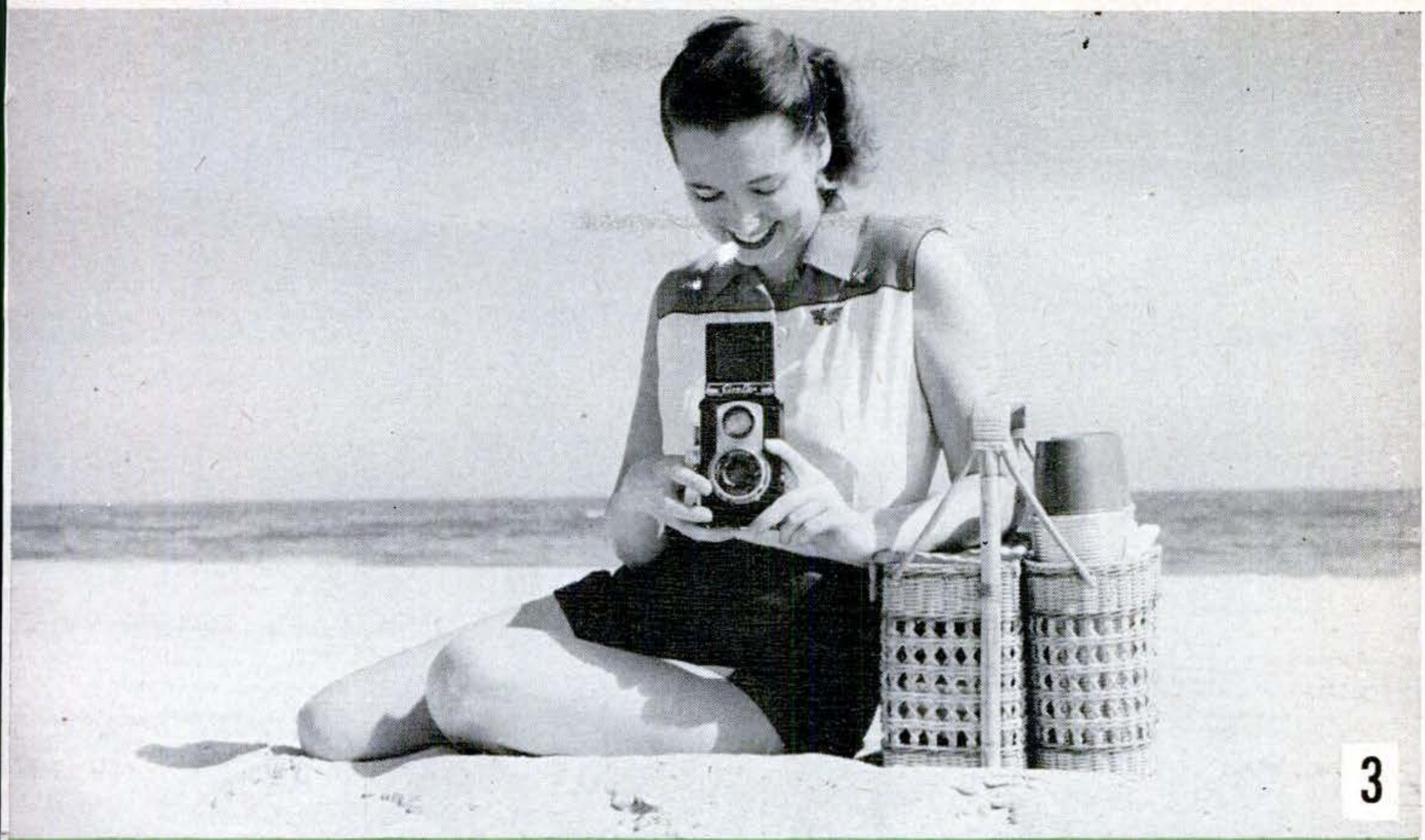
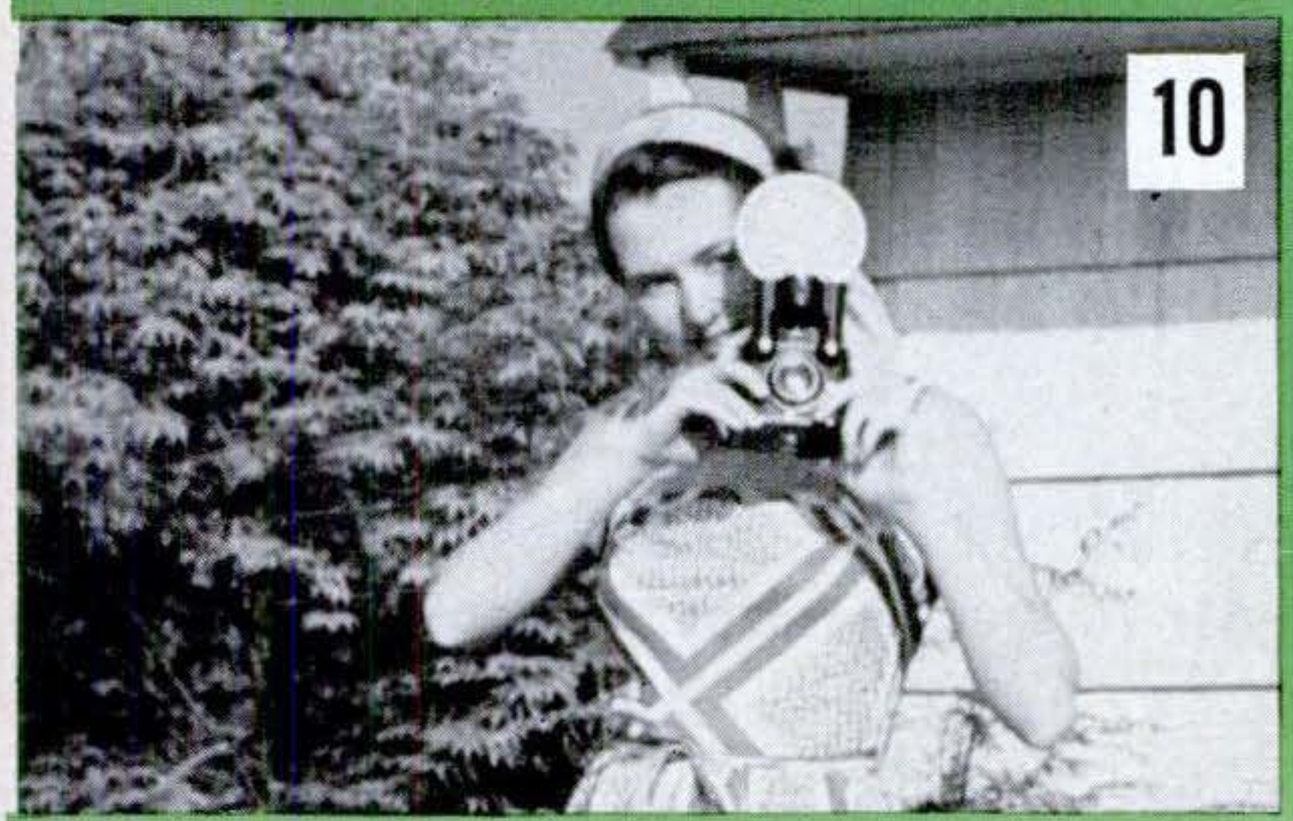
What Camera Are You Facing?

AS AN amateur photographer, you are usually the man behind the view finder—rather than the target. How well do you know cameras when the situation is reversed? The girl here is taking *your* picture with 11 different cameras. See how many you can identify. Then check with the answers at the bottom.





Answers: 1. Stereo-Realist; 2. Medalist; 3. Ciroflex; 4. Bolsey Twin Lens Reflex; 5. Leica; 6. Polaroid Land Camera; 7. Rolleiflex; 8. Voigtlander Brilliant; 9. Kodak Duaflex II; 10. Brownie Flash Camera; 11. Argus C3.

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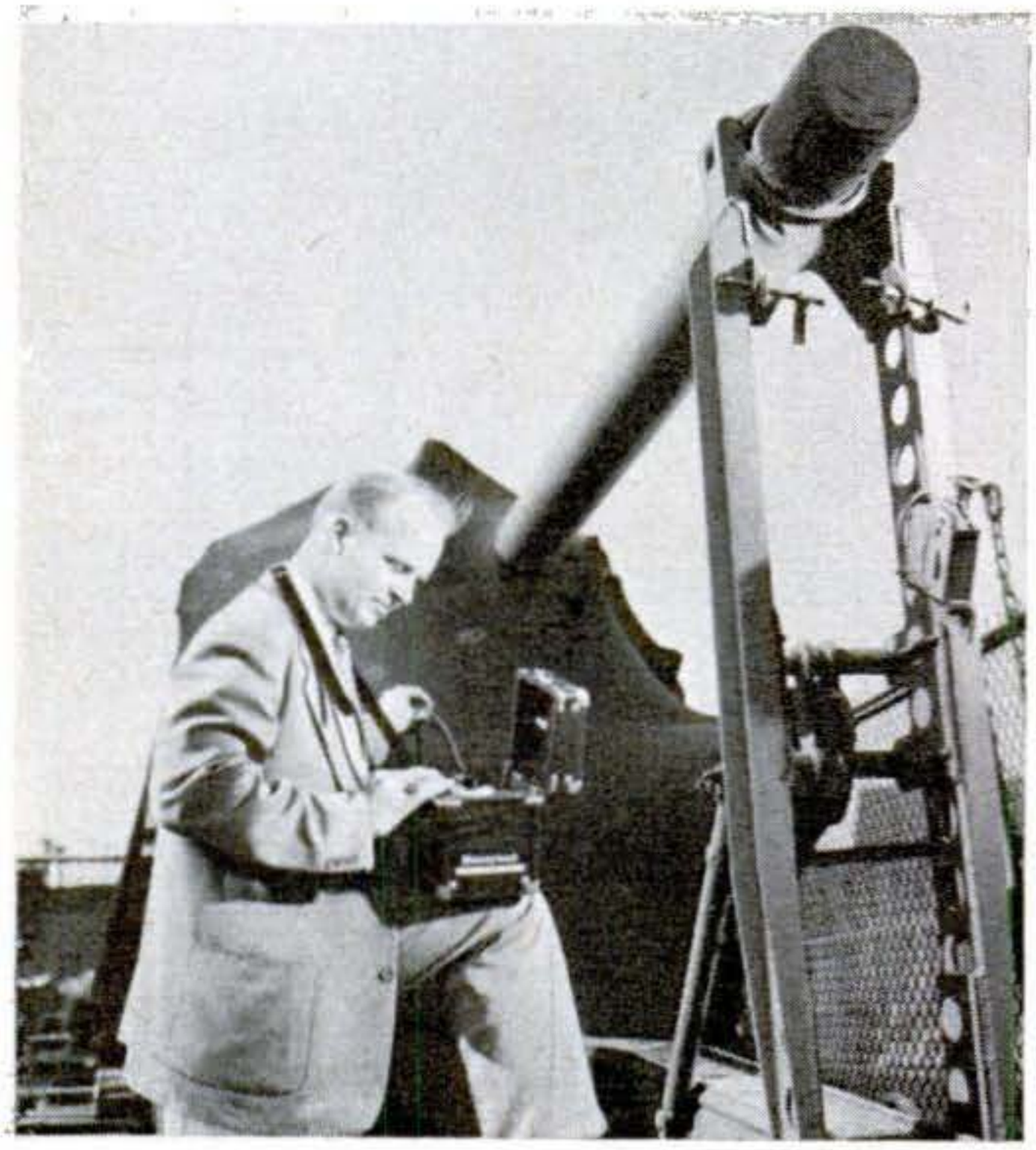
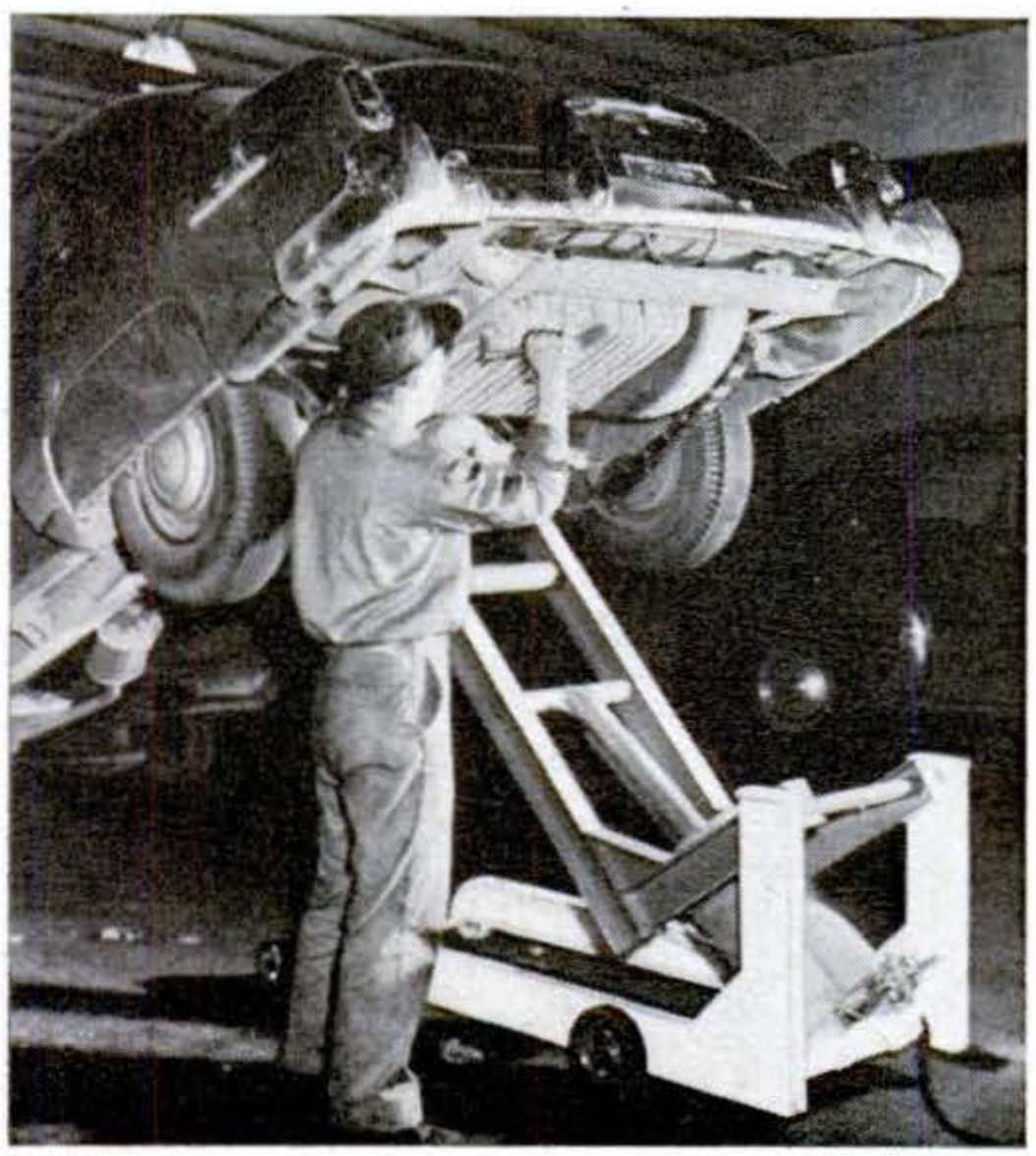
New Ball Game Lets You Exercise Without Chasing Balls

JOKARI (above) is a mixture of tennis, handball and squash. The ball is hitched to a central control box on a rubber cable that returns it each time it is swatted with the paddle. Played on any flat surface, the game requires no court, net or backstop.



Meter Guards Gun Against Rust

HE'S checking a moth-balled gun for moisture without unwrapping it. An electronic detector plugged into a socket on the plastic cocoon of a 90-mm. gun gets a reading from a sensing element inside.



Air-Powered Hoist Tilts Car

THIS air-operated hoist lifts the front or rear of a car as high as six feet and locks at any one of 10 working heights. The Homestead Valve Mfg. Co., Coraopolis, Pa., also makes a larger model for trucks.

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Stilts Give Workman a Lift

THIS insulation installer has worked on stilts for eight years without an accident. All crewmen of the Hugh R. Dodge Co., Detroit, don leg stretchers for work on ceilings so they don't have to rig scaffolds.

Pram Gives Baby a View

THIS Italian perambulator swipes a few styling ideas from fancy European cars. It has a sliding glass top, a full-vision windshield and a handsome chrome bumper. But mama still has to provide motive power.

▶▶▶They may not yell "Geronimo!" but beavers are making regular jumps these days. Parachuted to earth in canvas bags in remote mountain areas, the little animal engineers build check dams for the California Fish and Game Department. As the bags touch ground, they open automatically and conservationists waiting on the ground plant the released beavers by hand just where dams are needed.

Decorating Made Easy—Now the Wallpaper Goes Up Dry

THE lady wielding the roller is not painting a room, she's getting set to hang wallpaper by applying a new kind of paste that goes on the wall instead of on the paper. The unhandiest handy man can then unwind the pretrimmed wallpaper and press it into place as shown at far right.

A gallon of the adhesive—enough for an average living room—costs about $2.50. It's called EZE Hang, and the Commercial Packaging Corp., Hammond, Ind., makes it.

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WILBUR SHAW REPORTS FROM THE DRIVER'S SEAT:

This Monster Behaves Like a Midget

Power steering and twin 350-hp. diesels make mountain-moving light work for 50-ton truck.

I HAD a lot of fun the other day in a Kansas City sand-and-gravel pit, driving the world's biggest end-dump truck. I was in control of 50 tons of vehicle and 70 tons of sand, and it handled like a baby buggy. It was terrific.

The boys at the Dart Truck Co., who built the huge truck, proudly call it their Monster. In every dimension it is colossal, but it's as nimble as a midget. Its astonishing agility is partly the result of power steering and partly due to the mighty twist that 700 horsepower, assisted by torque converters and high-gear reduction, gives to the tandem rear axles.

The Monster's mammoth proportions —32 feet eight inches long, 11 feet 8½ inches wide, 11 feet six inches tall—alone do not make it a world's champion among

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RADIATORS

BOX-GIRDER FRAME

FAN SHAFT

HYDRAULIC STEERING CYLINDERS

PITMAN ARM OF CONVENTIONAL STEERING GEAR MOVES HYDRAULIC VALVES

HYDRAULIC VALVE DISTRIBUTES OIL TO CYLINDERS THAT TURN FRONT AXLE

AIR-STRUT CYLINDER

AIR-STRUT PISTON

BELT DRIVE TO FAN SHAFT

TRANSFER GEARBOXES

350-HP. DIESEL ENGINE

350-HP. DIESEL ENGINE

TORQUE CONVERTERS

REVERSE GEARBOXES

LEFT-HAND ENGINE POWERS THIS AXLE

AIR-BRAKE CYLINDER

PROPELLER SHAFT BRINGS POWER FROM RIGHT ENGINE TO TRAILING AXLE

REDUCTION-GEAR CASES

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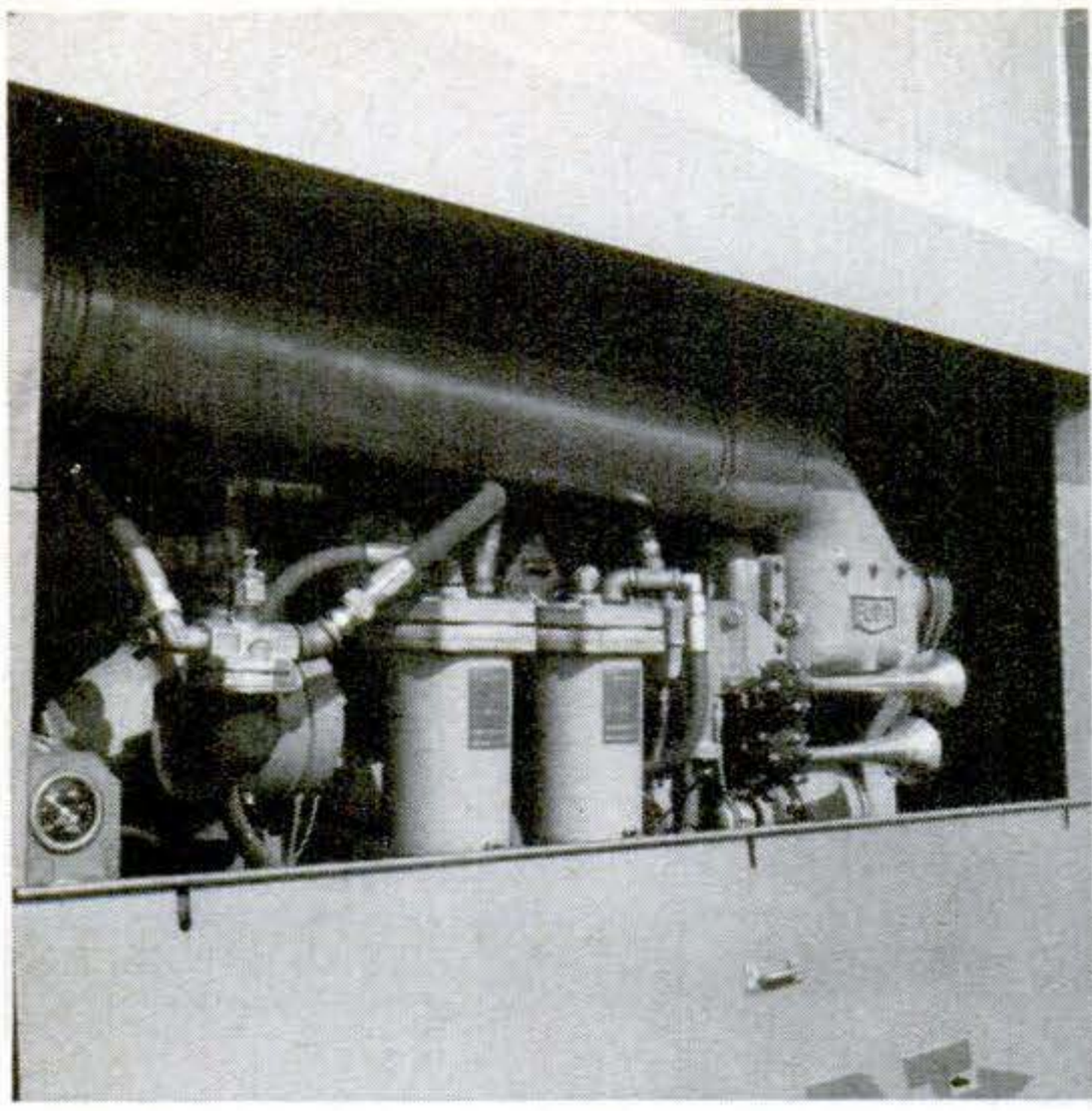
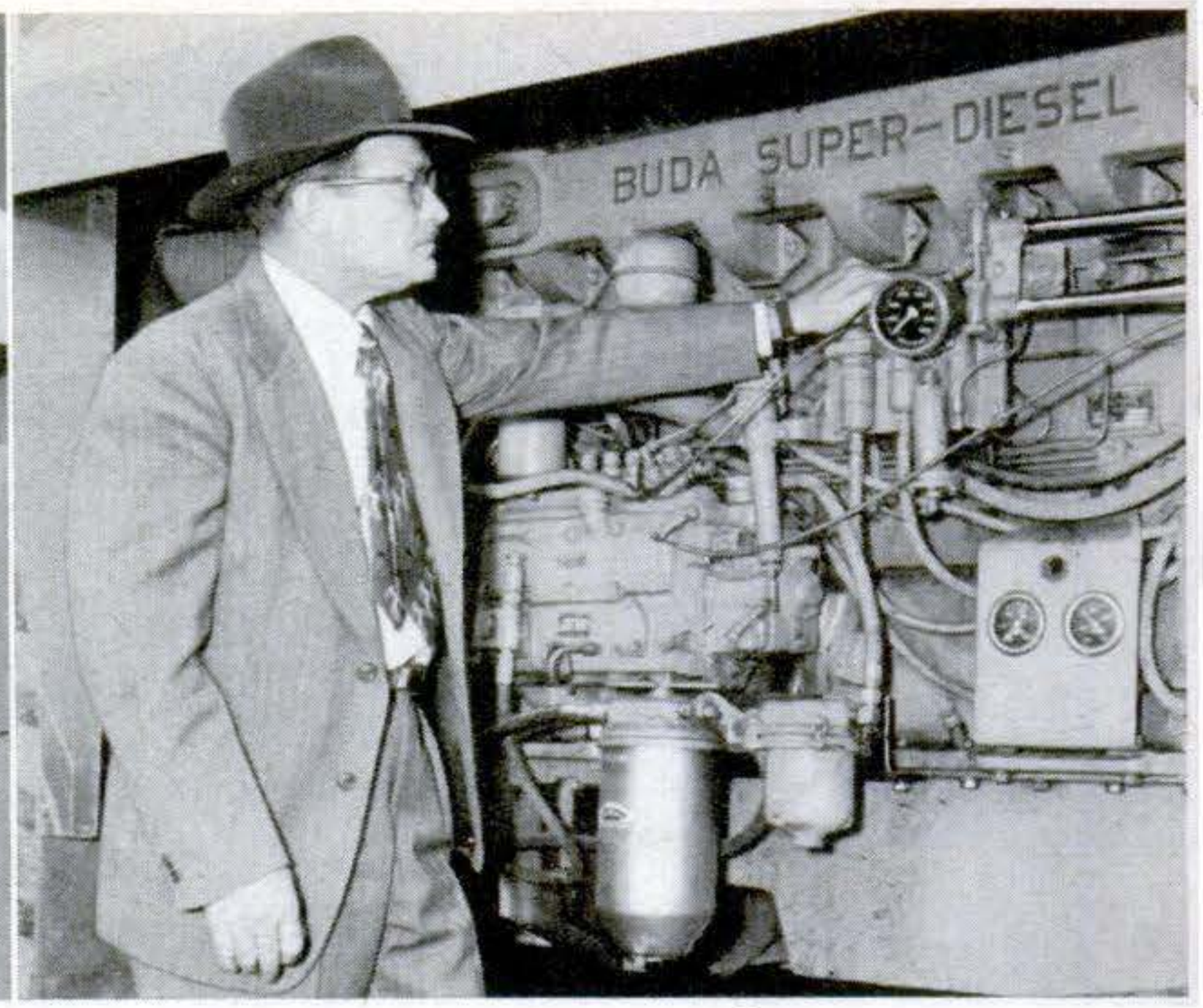


LIKE THE OLD PARLOR STOVEPIPE, the exhaust pipe from one of the Monster's diesels travels overhead, and, since the engine is reversed, vents in the direction the engine faces.



IF AN ENGINE OVERHEATS, or oil pressure drops, a pair of air horns on each engine (at upper right) set up noisy warning. Gauge I'm examining is tachometer used for tests.

end-dump trucks. What wins the Monster its title is its carrying capacity, which is what counts in a truck.

The Dart company has been custom-tailoring trucks to specialized needs for 50 years. It says this big boy can haul 60 tons. That is an understatement. I found that it will haul 10 tons more than that with ease.

Tires Are Truck's Back Muscles

Apart from the size and ruggedness of its steel body, which is built like a battleship's, and the strength of its axles, the huge truck's capacity depends on what the tires will support. That is where the Monster's back muscles are—in a dozen 32-ply tires, 18.00 by 25 in size, inflated to 80 pounds' pressure. Each is five feet three inches tall and capable of holding up 20,000 pounds. Add them all up and you have a carrying capacity of 240,000 pounds. The truck itself weighs close to 100,000, so you can pile 140,000 pounds of cargo on its back.

If Mohammed refused to come to a particular mountain, it wouldn't take the Monster long to bring the mountain to Mohammed.

As a matter of fact, the truck took off for the mountains shortly after I drove it. It was the first of six ordered by the Bagdad Copper Corp. of Arizona. It is now hauling copper ore from the bottom of an open-pit mine to the rim. It must climb 20-percent grades with a full load and achieve a top speed of 20 miles an hour over a route that doesn't exceed two miles.

With 70 tons aboard, it marched unhesitatingly up 12-percent grades for me and easily ran around the floor of the sand-and-gravel pit at 20 miles an hour. It couldn't have been more fun to pilot the USS *United States,* and I'll bet its driver on the job feels the same way about it.

Getting it out there was quite a project in itself. After all, the truck was illegal in almost every particular on the open highway. Kansas refused to let it set a single tire on its roads, even empty. So the Monster went west by train, bulging a foot over the edges of the flatcar on which it rode.

The giant truck's front end rides on captive air, in a massive hydraulic strut similar to those on the landing wheels of bombers and big commercial airliners. The strut rises straight up from the center of the front axle, its upper part half in and half out of the cab. The truck's

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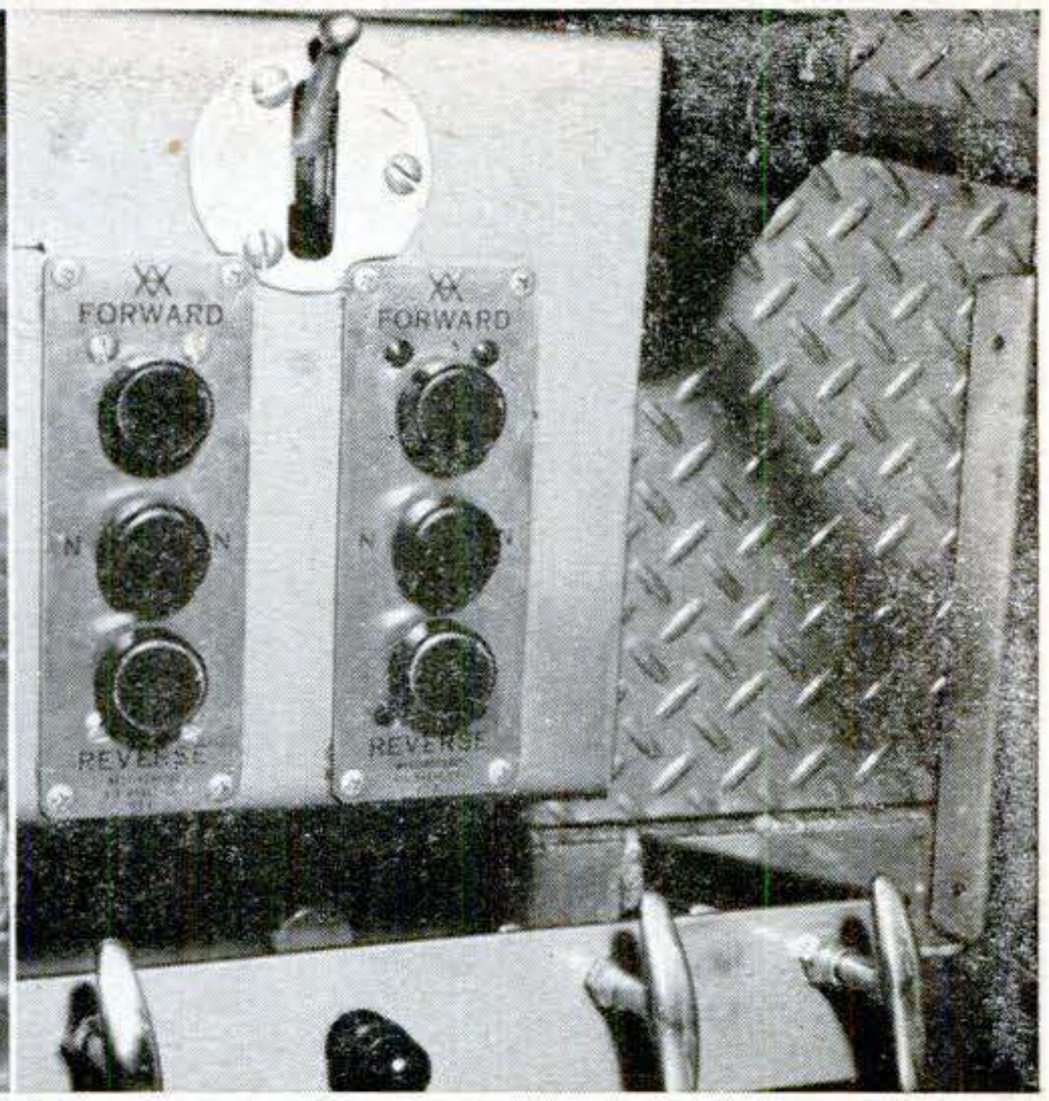
FEW ENGINE GAUGES are necessary. There are two to record torque-converter temperatures, two to show air pressure, and an ammeter. Emergency brake is beside my right knee.



PUSH-BUTTON CONTROLS on the floor beside the driver's seat operate air valves that cause a jaw clutch to lock the input and output shafts for going forward or backward.

GETTING RID OF 70 TONS is an easy matter. Those hydraulic hoists exert 170,000 pounds of push. Two engine-driven pumps supply pressure for hoists and power steering.

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engines are mounted off a single backbone, much as John Cobb arranged the engines on the car with which he established the present land speed record of 394 miles an hour. When the truck takes a curve, the whole front axle pivots, instead of the wheels, like the front axle of a million wagons, including your little boy's.

The engines, two 350-horsepower Buda Super diesels, are mounted amidships, on either side of a huge box frame. This frame contains the 250-gallon fuel tank.

The engines, two of the largest built for trucks, were put behind the cab to give the driver better visibility and keep him away from their heat and fumes and noise. Each engine drives a separate rear axle—the right-hand engine turns the rearmost, the left-hand engine the foremost.

But, to concentrate the power-plant components and their weight amidships, the designers decided that the engines and torque converters must be side by side. This meant that the engines would have to face backwards, and so they do. Power is taken off the rear (output shafts) of the engines by transfer cases, whose gear trains carry it inboard to the input shafts of twin torque converters nested parallel to the engines.

The problem of driving fans behind the radiators, which are up front and 12 feet away from the engines, was handled by belt-driving two shafts from the transfer case.

MONSTER'S GRANDDADDY above, born in 1903, was first Dart truck. Its engine was also located to rear of driver.

Triple-Stage Torque Converters

The torque converters are triple-stage, containing a kind of sandwich of three turbine impellers with stators in between the first and second and second and third turbines. At "stall speed," which is 1,700 r.p.m. on the diesels, the converters multiply engine torque five times. The over-all gear reduction in each rear axle is 20.6 to one. Therefore, at stall, you have the staggering torque multiplication of 103 to one.

Behind each torque converter—and I mean in the direction of the truck's rear—is a simple reverse box, providing one-to-one forward and one-to-one reverse ratios.

The drive shafts extend backward from the reverse boxes, one to a primary reduction gear on the foremost rear axle, the other to a primary reduction gear on the rearmost. The drive wheels are planetary, providing a five-to-one gear reduction in themselves.

An interesting feature of the torque converters is that they provide a considerable downhill - braking effect—a maximum of 520 brake horsepower, the engineers told me. You see, when you let up on the throttle suddenly and start down a grade, the turbine impellers are still whirling rapidly, and they, in effect, try to drive the idling engine impeller, which is impossible. As a consequence, a tremendous turbulence is created inside the converters, and the torque is applied in reverse, giving you a very noticeable braking effect.

I didn't dare rely on this at first, with 70 tons behind me, preferring to apply the air brakes, which have a total brake-lining area of 2,550 square inches and really bind the Monster down. But when I finally let the torque converters hold back the truck on an incline, I was amazed at how well they did the job.

Steering the Monster is so easy that I'm sure my wife could do it. You have to exert about as much effort as it takes to steer a medium-size passenger car that doesn't have power steering. The massive truck's hydraulic boosters apply 56,000 pounds' pressure to assist you.

As I said, I found the Monster a lot of fun. If you'd like to have one to play with, though, it'll cost you $98,500. END

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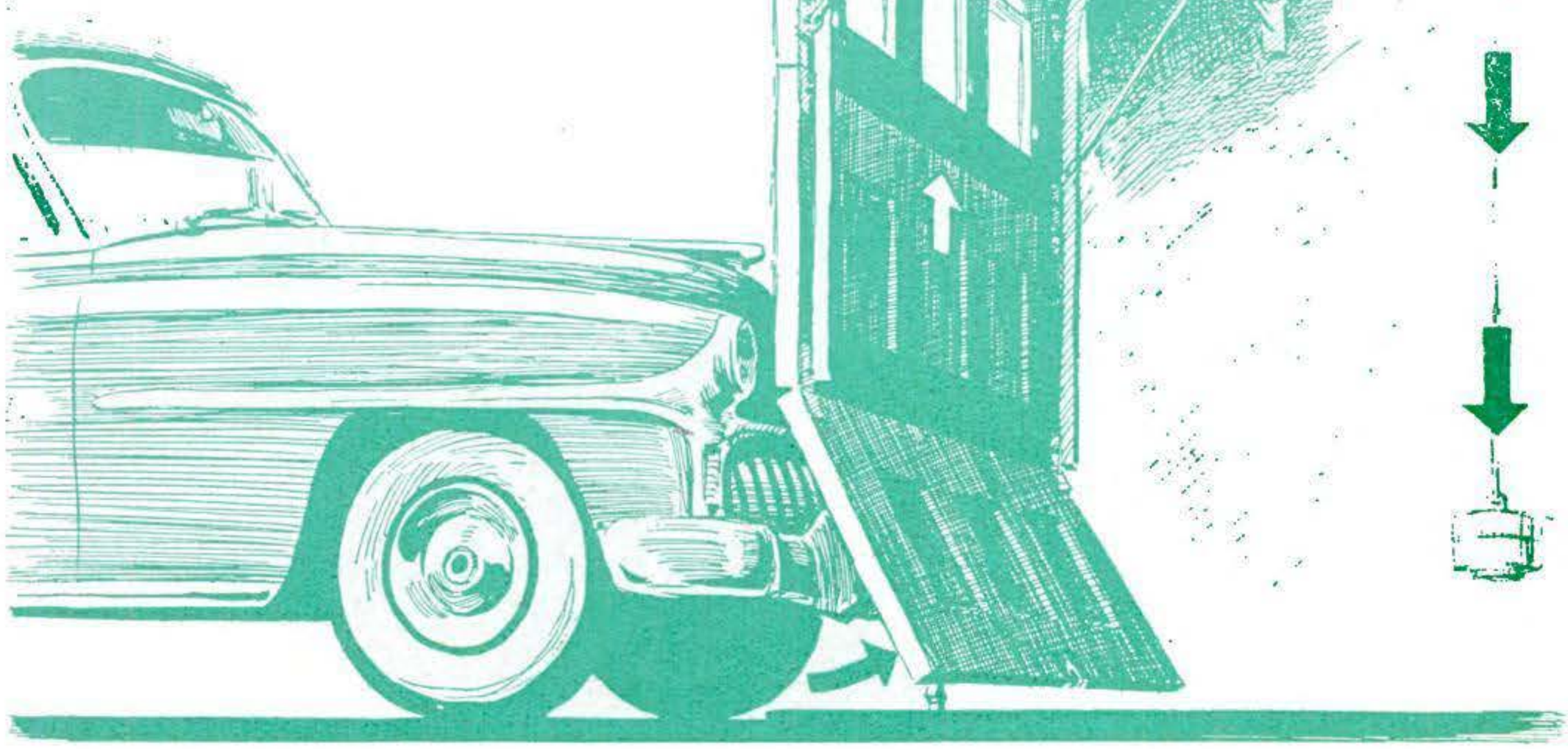
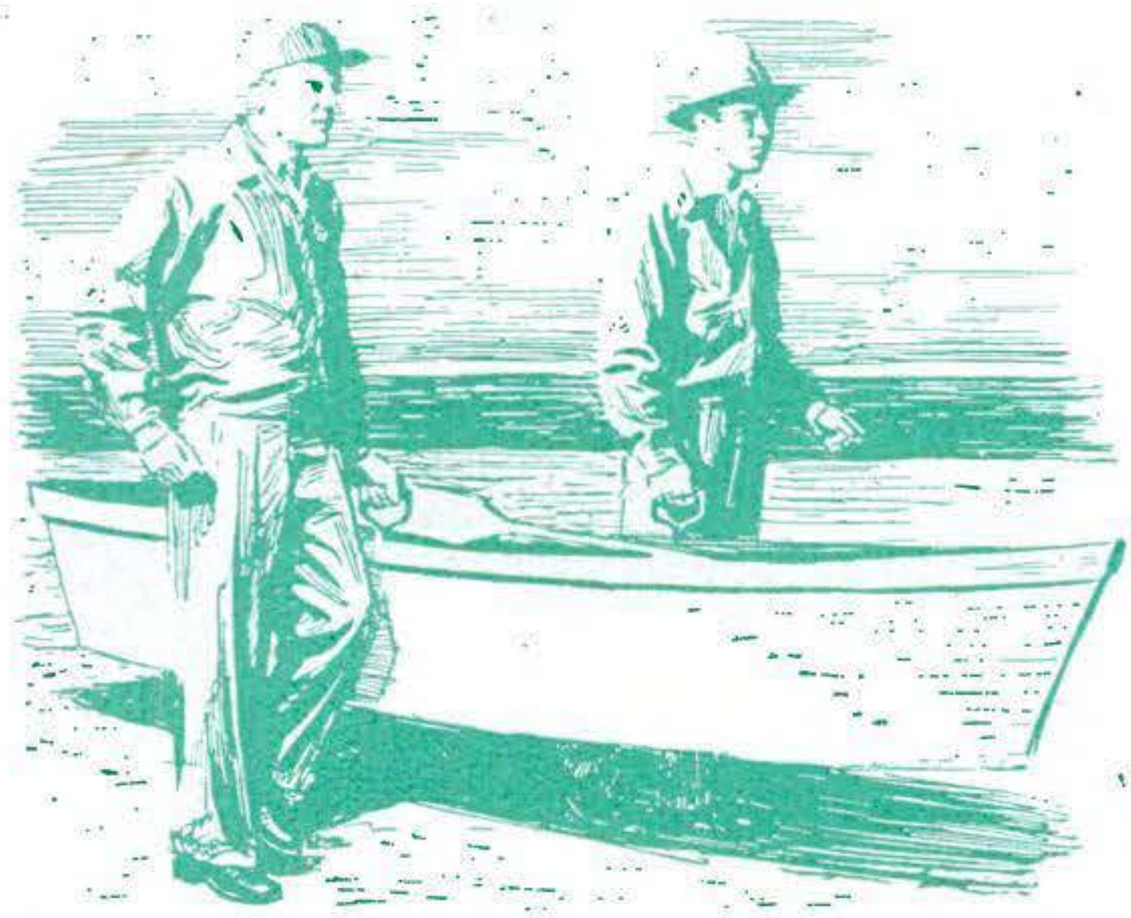
New Ideas
FROM THE INVENTORS



1 Garage Door to Open When Bumped. Instead of getting out of your car to open this garage door, you would gently nudge the bumper against the hinged bottom panel. This would move the panel inward and release the door catch from a projecting stud bolted to the floor. Counterweights would then lift the released door fully open. Bottom panel could be locked to keep door from opening accidentally.



2 Boat Handle to Grip Oar Bracket. It's not the weight but the awkwardness that makes it so hard to beach or carry a rowboat. This handle would eliminate the awkwardness. A wire bail, fitted with a wooden handle, would slip into each oarlock bracket, making it possible for two men to balance the weight comfortably.

3 Pliers to Straighten Bent Nails. The usual method of straightening nails often yields more dented fingernails than straightened iron ones. There'd be no hazard, however, if you did the job with pliers like these. Notches in the jaw and near the lever pin would grip a nail firmly and keep it from twisting while you pressed it straight.

Please turn the page for more new ideas.

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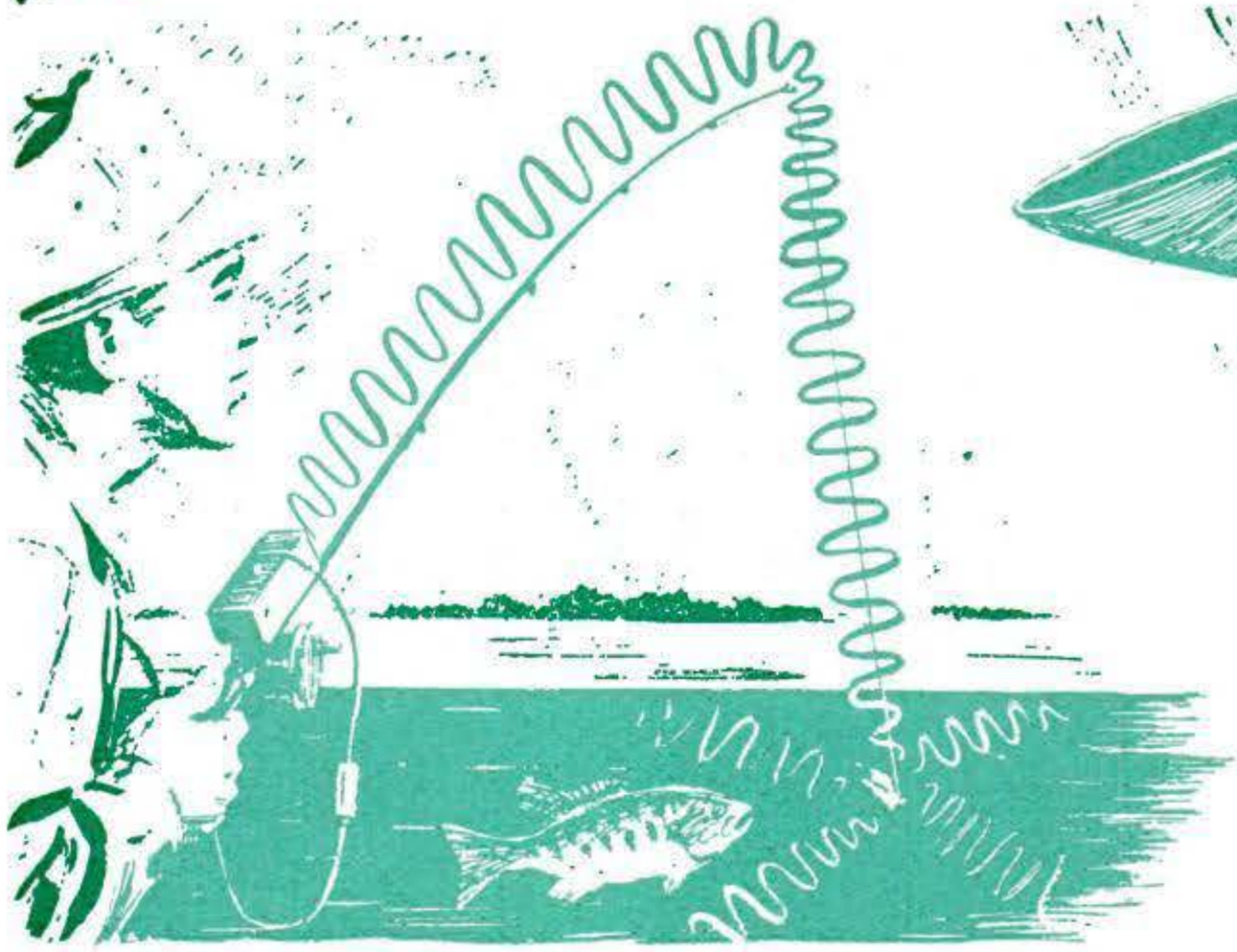
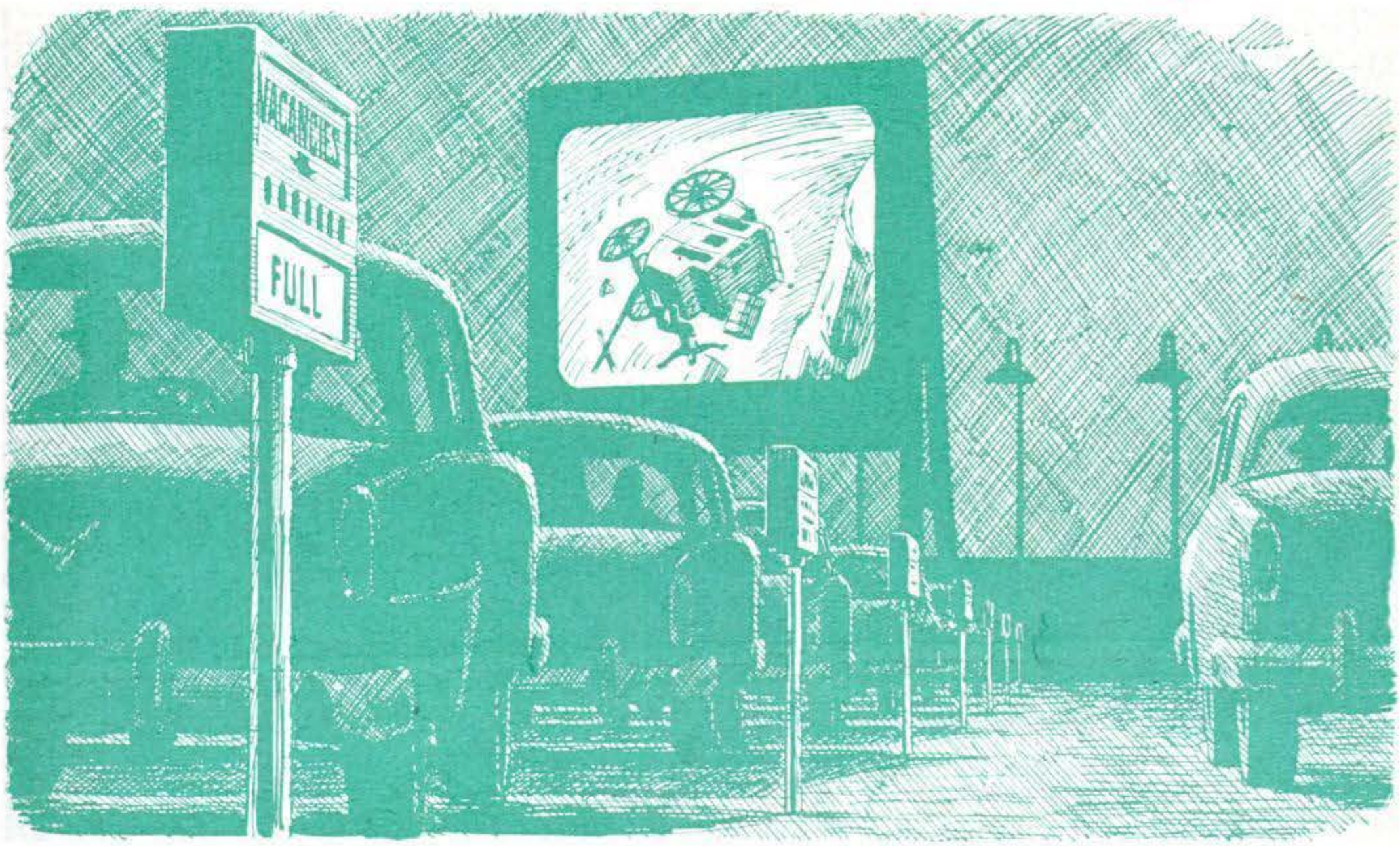
MORE New Ideas from the Inventors



4 Humming Fly to Attract More Fish. Fish can hear, says the inventor of this double-acting lure; so he proposes to make artificial flies sound as well as look like the real things. An electric vibrator produces an insect-like buzz which is carried through the rod and line down to the bait.

5 Plastic Umbrella to Pump Up. This ribless umbrella would blow up like a balloon. Deflated, it would be small enough to fit in your coat pocket. The three-section telescoping handle could be adapted to pump air between the welded plastic sheets that form the inflatable canopy.



6 Drive-in Signal to Show Vacancies. Cars wouldn't have to cruise around a drive-in if the theater had signals to show vacant locations. Indicator lights would be connected to switches on the speaker posts. When a speaker was lifted, the corresponding signal would blink off. If all speakers in a row were in use, "Full" sign would light up.

U. S. patents on these inventions have been granted to: 1. William R. Dadswell, Staten Island, N. Y.; 2. Morris D. Elder, Payne, Iowa; 3. Wilfred C. Hand, Mountainside, N. J.; 4. Stanley A. Wehn, Santa Monica, Calif.; 5. Henryk Kaston, NYC, and Thomas Fawick, Cleveland; 6. Albert H. Reynolds, Dallas.

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Subway Alarm Calls Cop

A DESERTED subway station is a mighty lonely place to face a thug. The alarm pole being installed above at the entrance to a New York City subway lets the man in the change booth call for help. A push on a pedal flashes a light, clangs a bell—and brings the nearest policeman on the double.

There Are No Strings to This Piano

THE musician above is playing a German instrument that has a keyboard like a piano but produces sound the way a glockenspiel does. Instead of vibrating taut wires, the tiny hammers hit against metal bars made of a special alloy. It's called the Campanella and sells abroad for about $238.

Oxygen Bar Gives Workers Fast Pickup

AT THE Livestock Exchange in Omaha, weary stockmen are sniffing oxygen for a lift. Inhaling the gas—25 cents for a one-minute charge—is said to give a cooling sensation, followed by a feeling of buoyancy that lasts from one to three hours.

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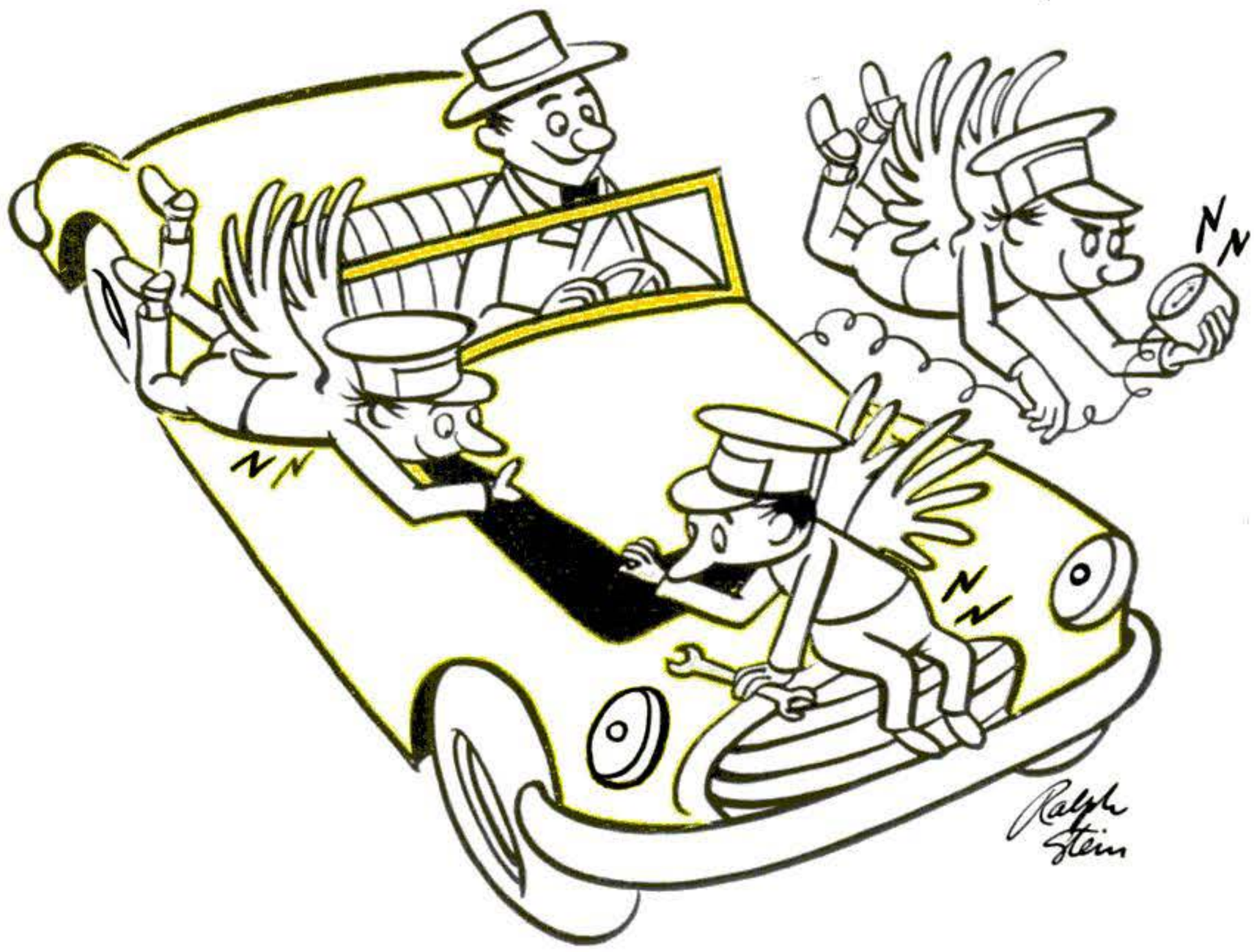


Clever Teamwork Guards Your Car's Electric System

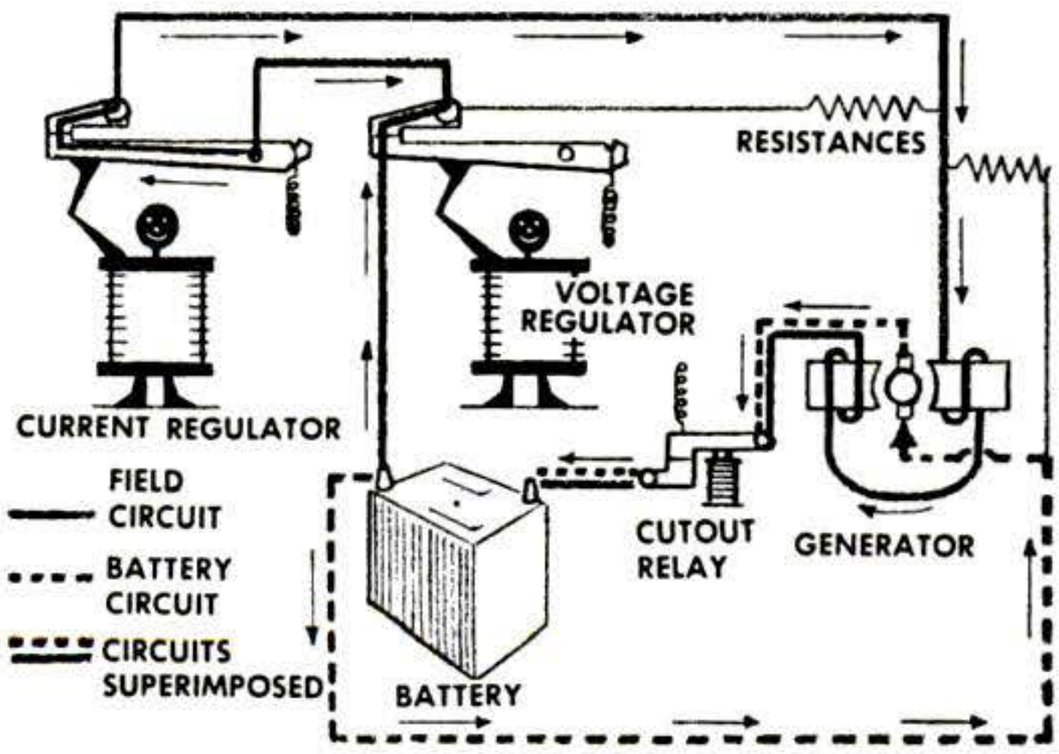
PROBABLY you have never thought of your car as an electric power plant on wheels. But the combined generator capacity of our 40 million passenger automobiles is more than seven million kilowatts—or nearly one-fifth as great as the total capacity of all of the electric power stations in the United States.

In the big hydroelectric and steam-electric generating plants, technicians called load dispatchers keep an eye on the constantly changing power needs of our cities and rural areas. From minute to minute they balance these demands with just the right amount of electricity.

Your car has a load dispatcher, too, or more correctly, three load dispatchers, all housed in a little box attached to the generator. Each is an electric switch, or relay, wired to its companions in such a way that whether your battery is weak or strong, or the engine is racing or standing still, with half a dozen electrical appliances cut in or out, your generator output is adjusted instantly.—*Henry B. Comstock.*

Current and Voltage

WORKING WITH THE CUTOUT RELAY are the current and voltage regulators. Their action is intermittent, and either may open and close as many as 250 times a second to maintain balance between the electrical demands of your car and its generator output. Both relays reduce the output by cutting resistance into the generator's field coils. In the drawing below, they are idle, allowing full current to flow through the field. Generator is now producing maximum output.



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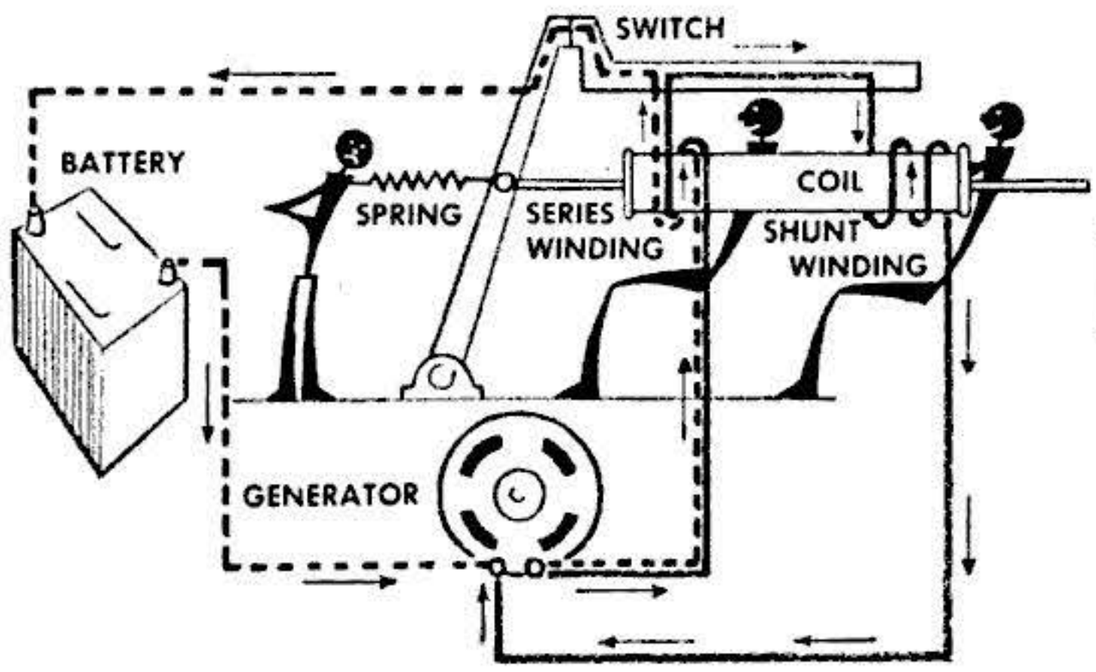
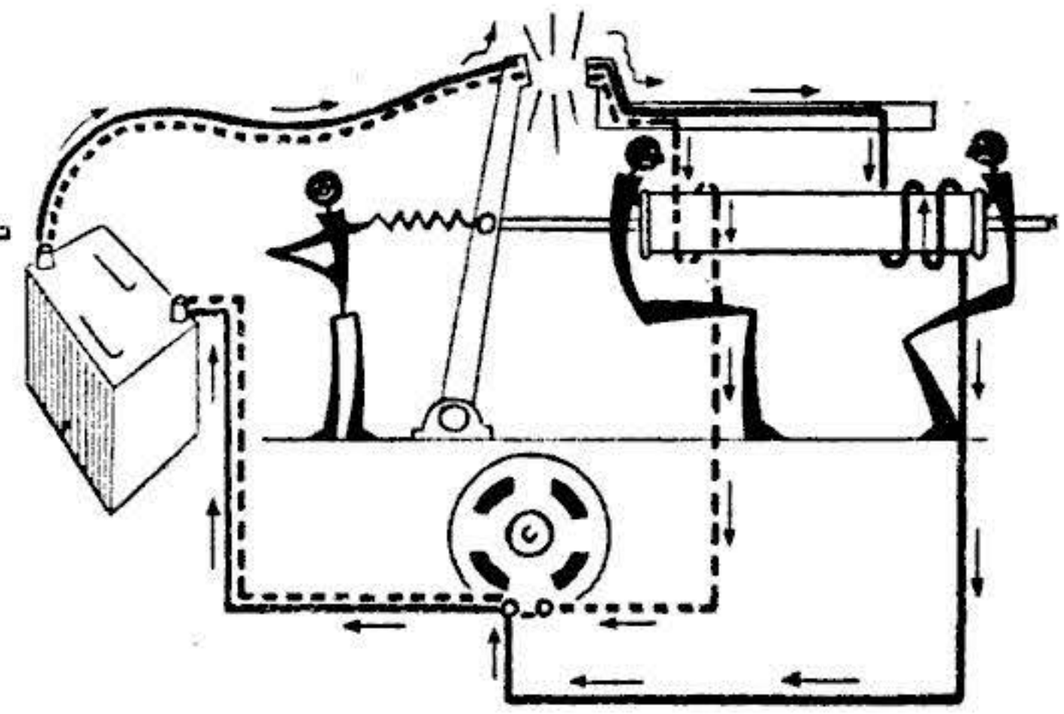
Cutout Relay Is the Captain of the Three-Switch Team

ACTING as a one-way electrical valve, the cutout relay allows current to flow from the generator to the battery, but prevents the battery from pouring current into an idle generator. Without the cutout relay, battery feedback would burn out the generator and run down the battery charge. Two drawings below show how two-coil relay works.



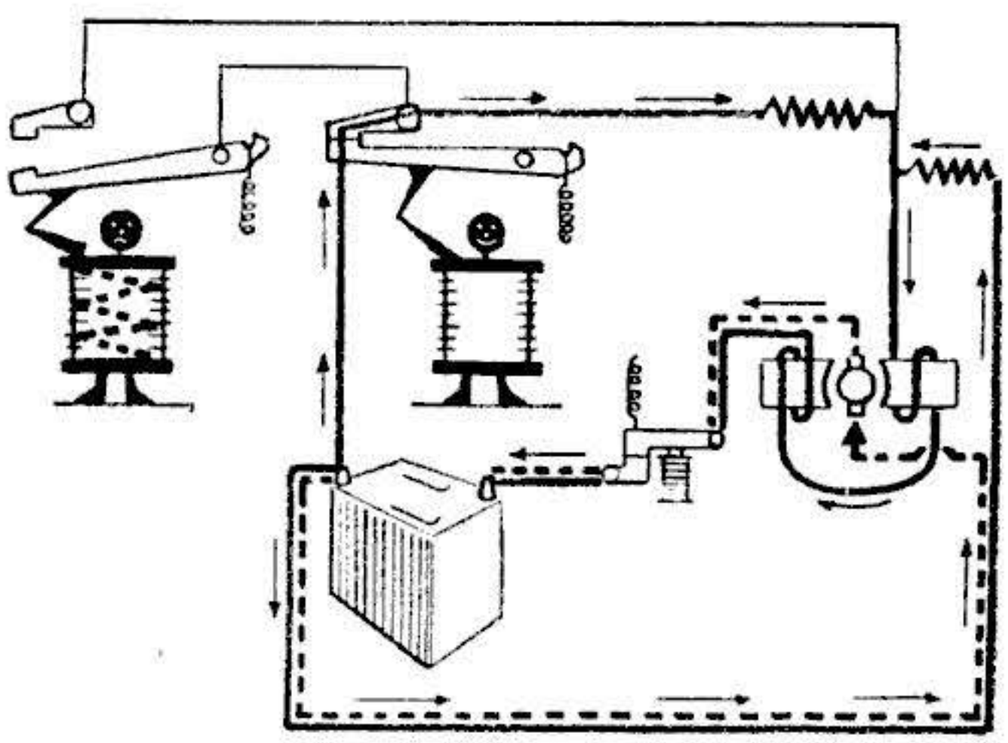
DIRECTION OF CURRENT flowing around its core determines the polarity of an electromagnet. For this reason the cutout relay has two windings—one clockwise, the other, counterclockwise. When generator output is strong, electricity passes through both coils, but in the same direction (see arrows). Resulting strong magnet overcomes tension of spring and closes switch points, completing circuit between generator and battery. Current now charges cells or runs equipment.



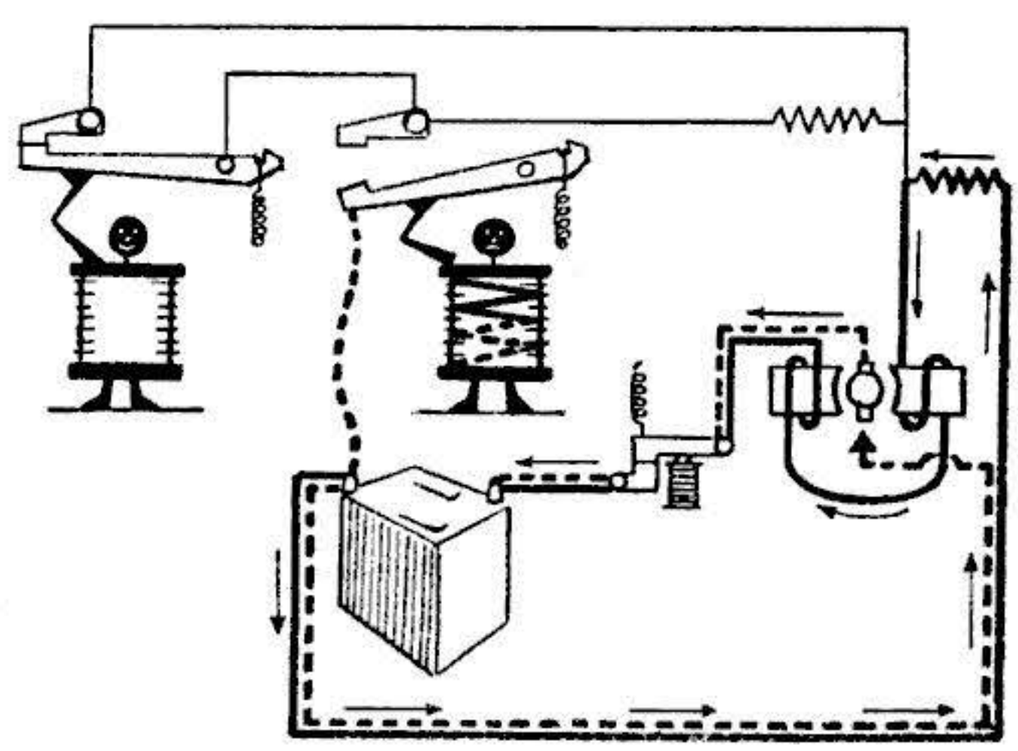
BATTERY sends current back through cutout-relay switch contacts when generator is idle. Beyond the switch, current divides to feed both series and shunt circuits. Its flow is now in opposite directions through the coil windings. This neutralizes polarity of the magnet, and the spring opens the switch. No more current can flow from battery to generator. Shunt winding closes switch contacts again when generator goes back to work.

Regulators Control Field Strength

WHEN BATTERY IS LOW, or power drain is heavy, your generator overtaxes itself to meet demand. Current regulator responds to heavy power surge and opens switch, shutting off normal generator field circuit. Two resistance circuits now feed somewhat less current to the field, reducing generator output. Current-regulator magnet loses grip on switch, and normal field circuit is restored. This cycle is repeated intermittently, to stabilize current output.



WITH BATTERY APPROACHING FULL CHARGE, voltage increases as generator tries to force more current into the cells. This automatically lowers current output, which is good. But high voltages will damage car's electrical system. Voltage regulator responds to increased "pressure" and cuts out one resistance circuit. Remaining resistance circuit can pass little current to the generator field. Now, both voltage and current output are lowered.



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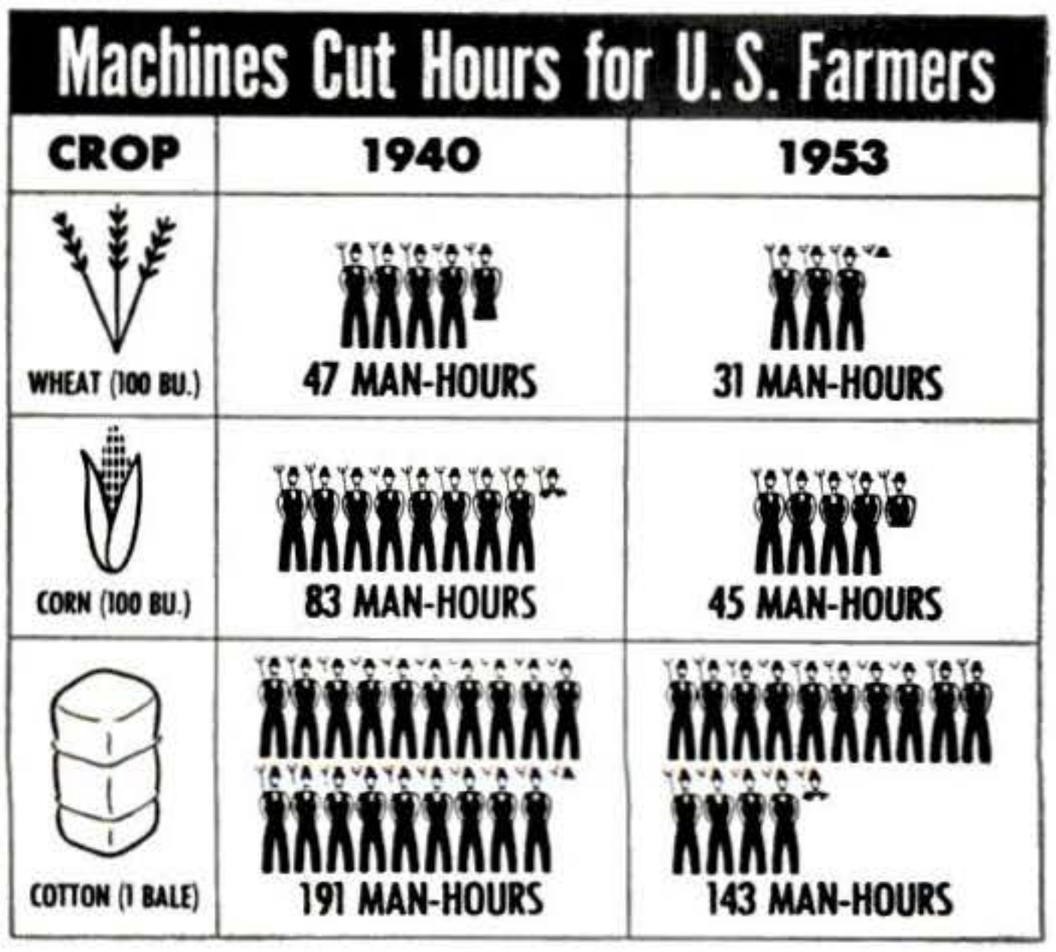
P.S.

Last minute news & notes...

CHEAPER WAYS to diagnose polio are in sight. Alabama scientists have succeeded in growing in mice the third of the three known polio strains. This may also help develop a new vaccine, since the polio strain seems to lose its virulency after going through mice. Dentists are catching gum and tooth troubles earlier by using black light that shows up symptoms ordinarily invisible. They're also studying the use of ultrasonic waves to drill teeth for filling . . . In industry, ultrasonics have been put to work finding invisible cracks in huge steel parts--flaws distort the sound waves passing through the metal. . . . And a Scots professor says he can mature Scotch whisky in one day with ultrasonic waves. But you must drink fast--it goes raw again in a few hours.

1953's TRUCK DRIVER OF THE YEAR, Pat Burkholder of Sparks, Nev., has driven more than 1,500,000 miles without an accident--equal to 150 years of ordinary driving. He has risked his life several times to save motorists injured in crashes.



THE WELL-DRESSED CAR today has nearly three times as many light bulbs as in 1940--38 of 'em . . . Doctors blame "blackouts" for a lot of auto accidents--say such sudden fainting spells are caused by emotional stresses, fright, bad heart conditions. Anyone with a sensitive carotid sinus should beware tight collars: turning his head to park may black him out . . . Drive-in theaters are having windshield problems. Tinted glass spoils color films, while curves partly depolarize 3-Ds.

EARTH'S LIQUID CORE, an English physicist believes, has jet streams and swirling currents similar to those in the upper atmosphere. This would explain irregular rotation of the earth and rapid changes in earth's magnetic field . . . "I Dreamt I Dwelt in Marble Halls" may become the atom scientist's theme song. Marble slabs are said to shield radiations as effectively as lead--and they're cheaper.

NEW SYNTHETIC RUBBER reported by Goodyear combines the top qualities of all present major types. Called polyester rubber, it's said to be 50 to 100 percent stronger than any other, to wear twice as long as the best cold rubber, equal the best inner-tube rubber for holding air, match neoprene in standing up against oils.

LAST STRAW for engineers working on auto air conditioners: Chrysler reports that, aside from the sun beating on the car roof, the high engine-compartment and exhaust-system temperatures, and the heat reflected from sun-baked highways, there's also a substantial amount of heat radiated by the human body. Six people in a sedan create enough heat to melt about 20 lb. of ice per hour.

BOSTON UNIVERSITY has found a way to process aerial photographic films in a single bath. Development and fixing chemicals are carefully balanced. . . . Rug makers say new chemical treatment of synthetic carpet fibers makes them so dirt-resistant they last much longer.

The Editors

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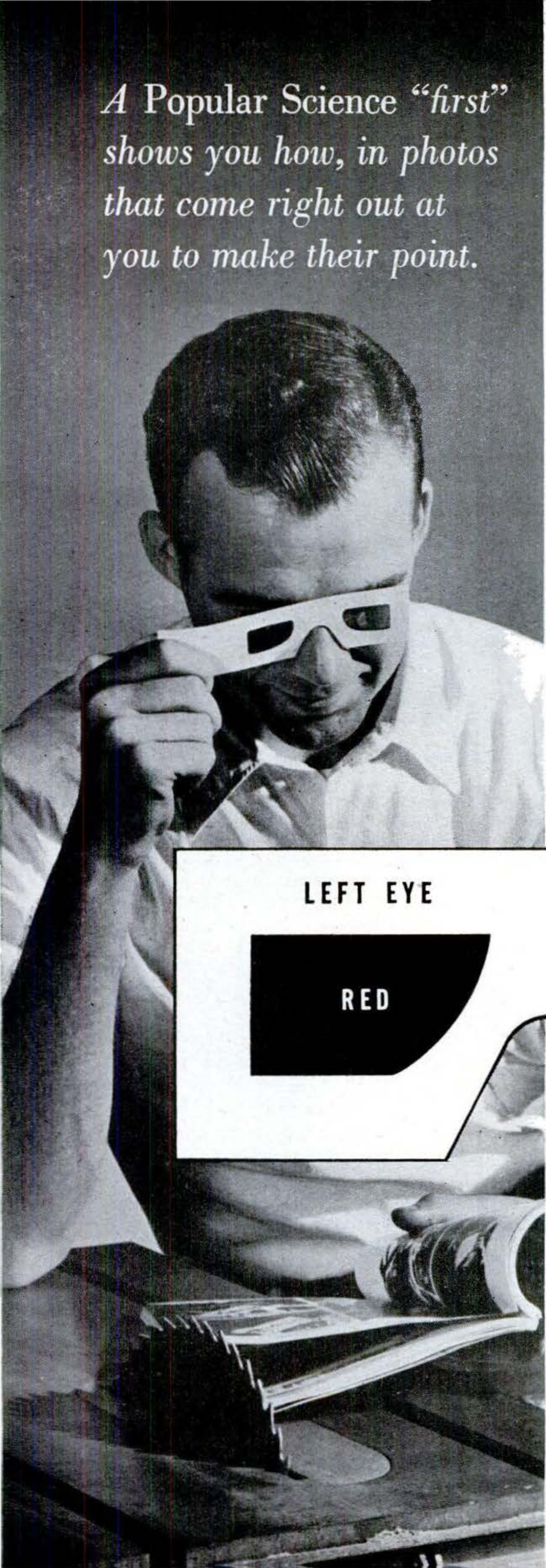
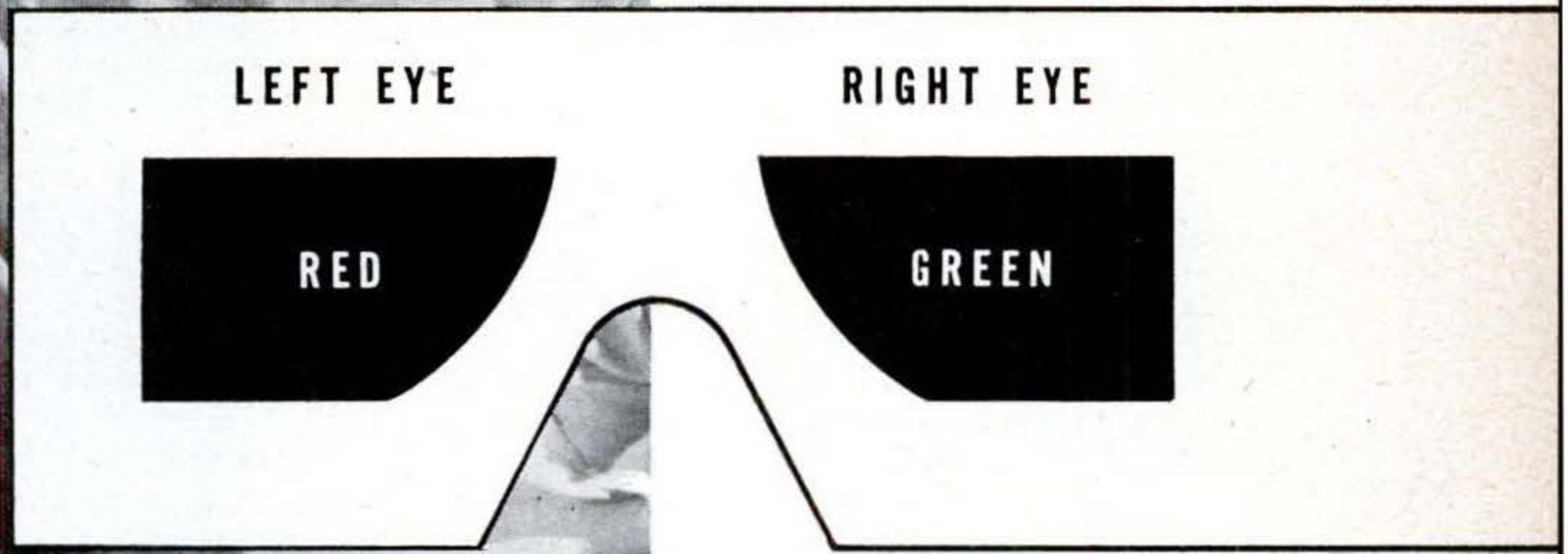
A Popular Science *"first" shows you how, in photos that come right out at you to make their point.*



MECHANICS *and* HOMEBUILDING

3-D Pictures

Show Errors in the Use of Circular Saws



By Harry Walton

THE circular saw is the top tool on many a home craftsman's list, and rightly so. You can do a lot with it but, like anything else, there's a wrong and a right way.

Here for the first time are pictures that make the most common mistakes stand out before your eyes. The saw, the work, the accessories and even the tie no well-dressed craftsman should wear pop right out from

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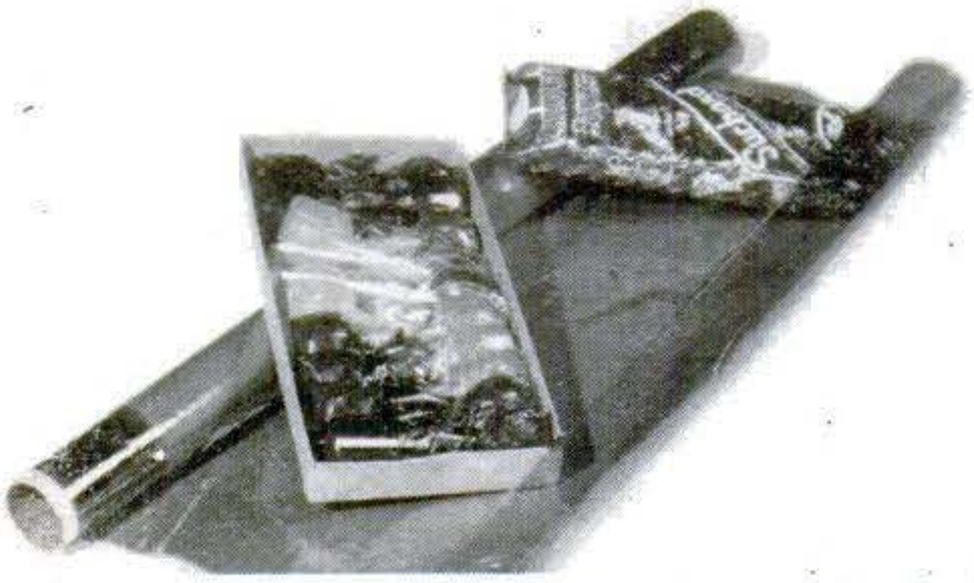
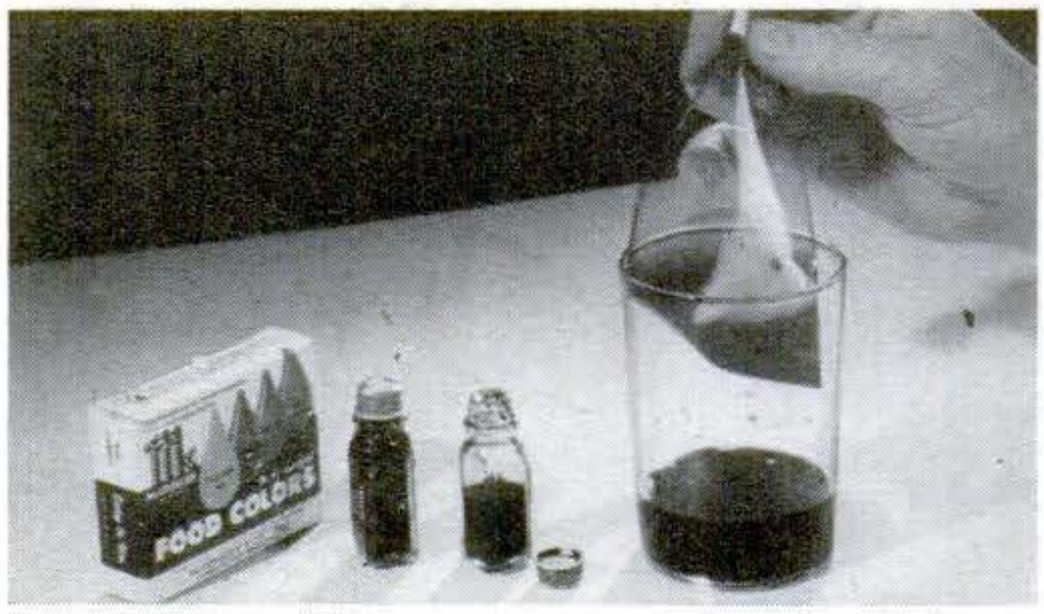
Three Ways to Make Your Own 3-D Viewers

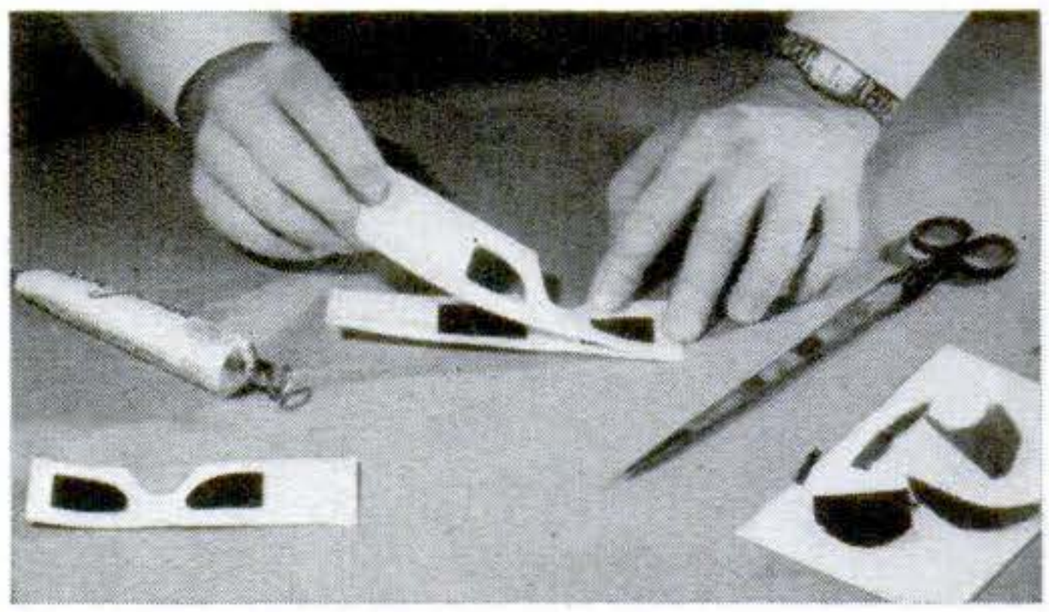


SCROUNGE CELLOPHANE. Many candies and other edibles come wrapped in colored cellophane. You can also buy it as gift wrapping. Look for a deep red and medium green. If colors are light, use two or three thicknesses. Avoid wrinkles, which impair transparency.



DIP DUD FILM. What photographer hasn't some blank, developed film on which the camera shutter never clicked? Add 40 drops red (or green) food color to ¼ cup warm water. Dip the film until sufficiently deep in color, testing as explained in the text.

JELL YOUR OWN. Dissolve an envelope of unflavored dessert gelatin in three oz. warm water. Heat in double boiler until dissolved. Add seven drops of food dye to a teaspoonful, and pour carefully onto enameled jar lid. Let harden 24 hours before peeling off.



MOUNT IN FRAME. With carbon paper or by making pin pricks at ¼″ intervals, transfer the viewer pattern on page 141 to thin cardboard. Cut out two frames and cement your cutout filters between them, the red at left, the green one and finger tab at right.

the page. In these 3-D [illegible] photos you'll see [illegible] and remember [illegible]

Each [illegible] 146 [illegible] a few [illegible] over the [illegible] green [illegible] called [illegible] the [illegible] must [illegible] one [illegible] left:

[illegible] cut [illegible] also [illegible] in the [illegible] gray [illegible] eye.

The [illegible] fore [illegible] the red [illegible] ribbed

with separate stereoscopic pictures, normal [illegible] these [illegible] stereoscopic [illegible] and 3-D [illegible].

Make your own specs. Any moder- [illegible] gelatin [illegible] view [illegible] light [illegible] parts of [illegible] effect. [illegible] three [illegible] red and green [illegible] graph [illegible] perhaps [illegible] transmitted [illegible] is a [illegible] green [illegible] right at the [illegible].

To test the filters separately, look at the red letters on the next page through the

Copyrighted material

WRONG

DON'T STRAIN like this to saw a big panel. Besides leaving off the blade guard, this optimist is trying to follow a pencil line freehand, while supporting the overhanging part of the sheet in mid-air. If nothing worse happens, he'll get a rough edge.

Circular-Saw Blunders in 3-D

Are you sharp on power-saw savvy? Try to pick the boners before reading photo captions.

STEREO PHOTOS BY HUBERT LUCKETT

RIGHT

red filter. They should disappear. The green type will not vanish as completely when seen through the green filter, but it should fade somewhat into the paper.

If you're tempted to wait and bring home a viewer from the next 3-D movie you see, don't bother. It will have Polaroid filters, made for viewing pictures projected by polarized light. Such a viewer will not show any stereo depth in the red and green composite pictures on these pages. It's easy and rewarding to make your own viewer. You, your family and friends will enjoy seeing these pictures come alive with startling 3-D realism.

Viewing them involves no eyestrain or special effort for normal eyes. Place the page squarely in front of you in a good light. Hold the viewing specs with the green filter in front of your right eye—and there you are.

DO USE a support, and keep blade guard on. Fence goes on outboard support of this multipurpose tool. Watch at fence to guide work. On other saws, use a roller support. If fence cannot be used, clamp wood strip under work. Guide strip against edge of saw table.

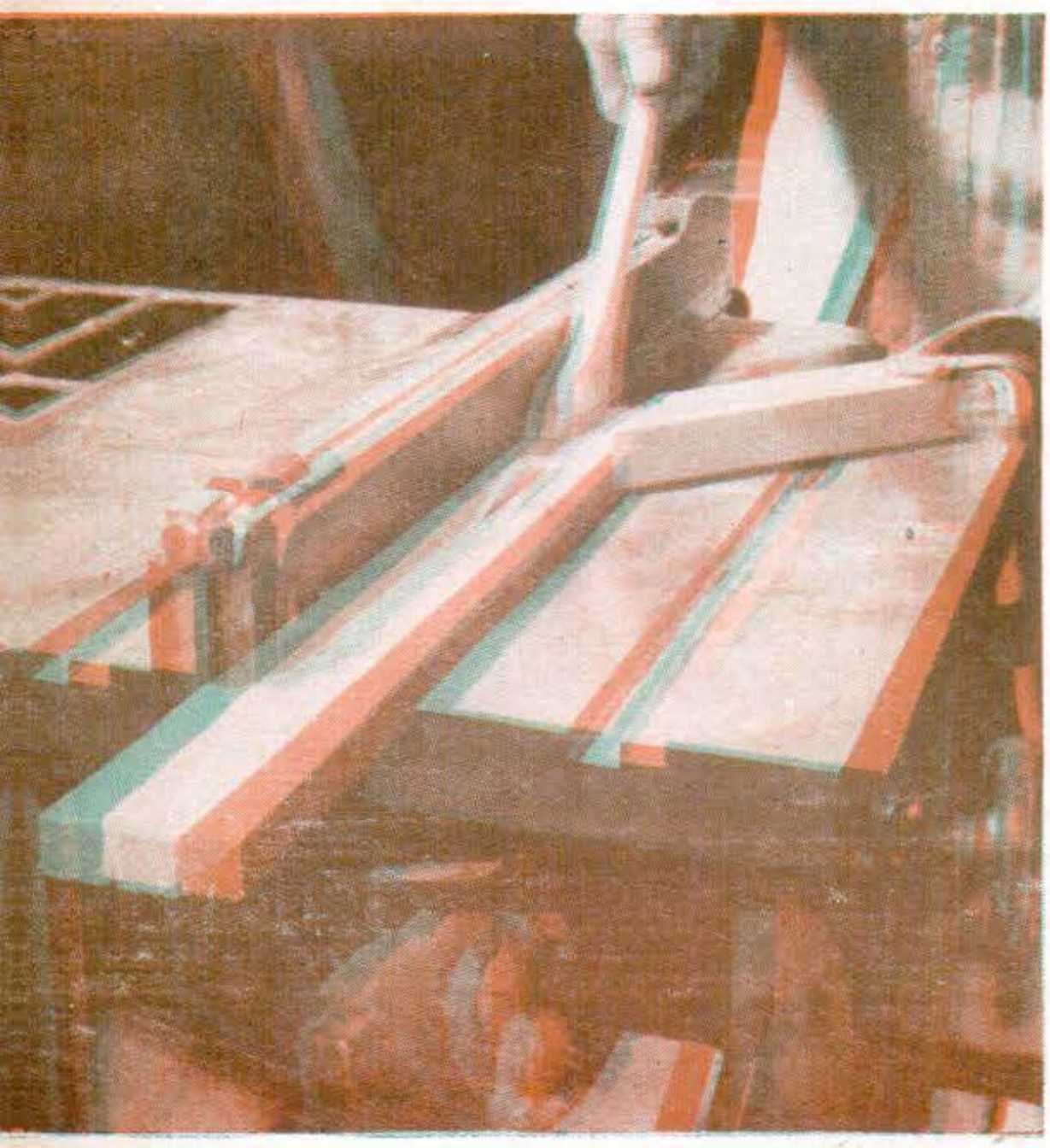
Please turn the page for more 3-D photos.

Copyrighted material

WRONG

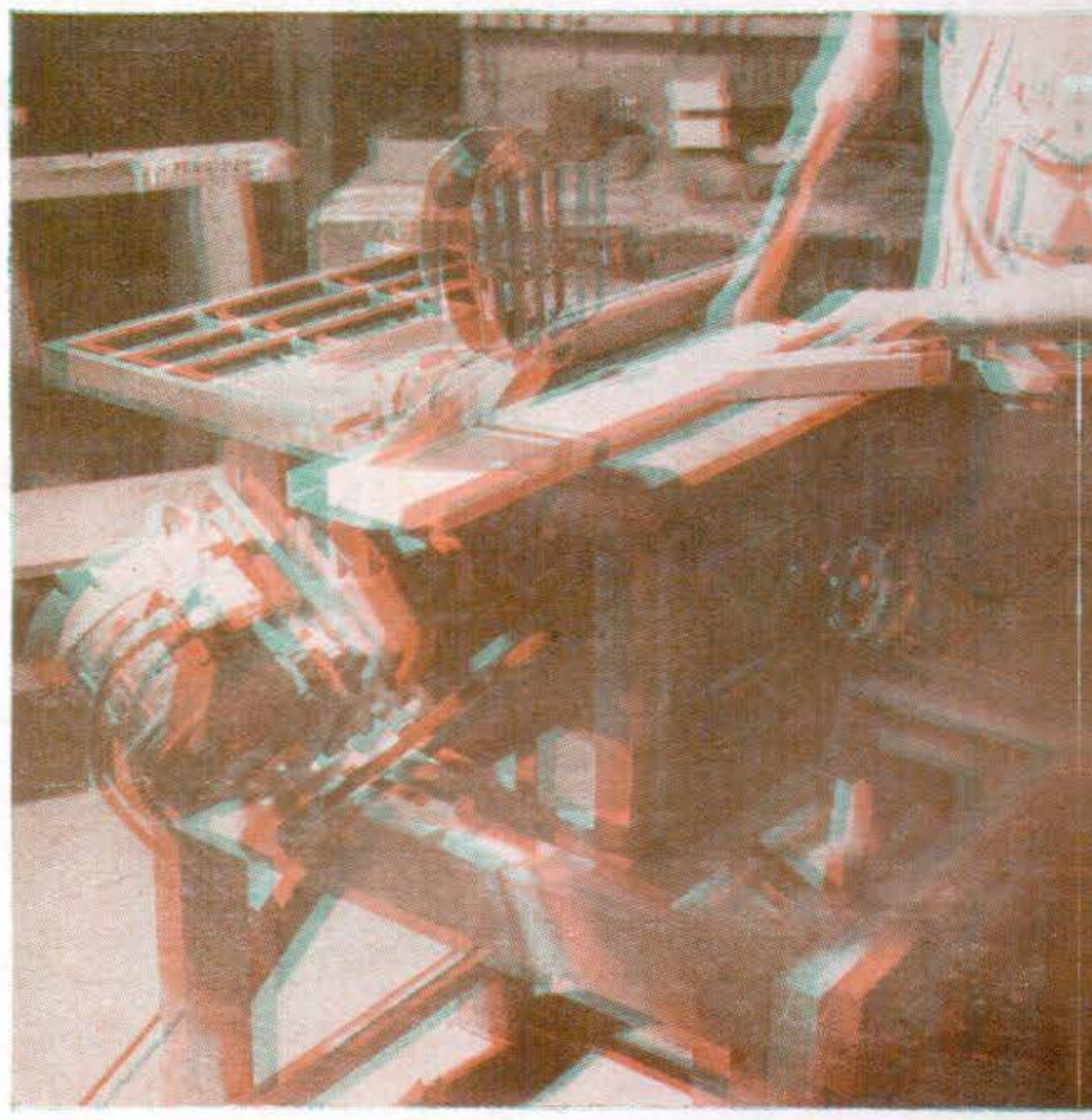
NEVER RIP narrow strips by pushing work through with hands. Nonchalant craftsman below may have nerves of steel, but not fingers. Cluttered table, tie and absence of guard invite grief.

IT'S BAD to tilt the blade or table for angle cutting so that teeth skim the fence. If blade binds or work wanders, they may bite. Guard and splitter are needed. Another error is guiding work with sharp corner of its beveled edge down; it may creep under fence.



RIGHT

ALWAYS FEED narrow pieces to saw with a push stick. Guard and splitter, here omitted to show cut, should also be used. Splitter holds kerf open and work against fence. Feather board prevents kickbacks.



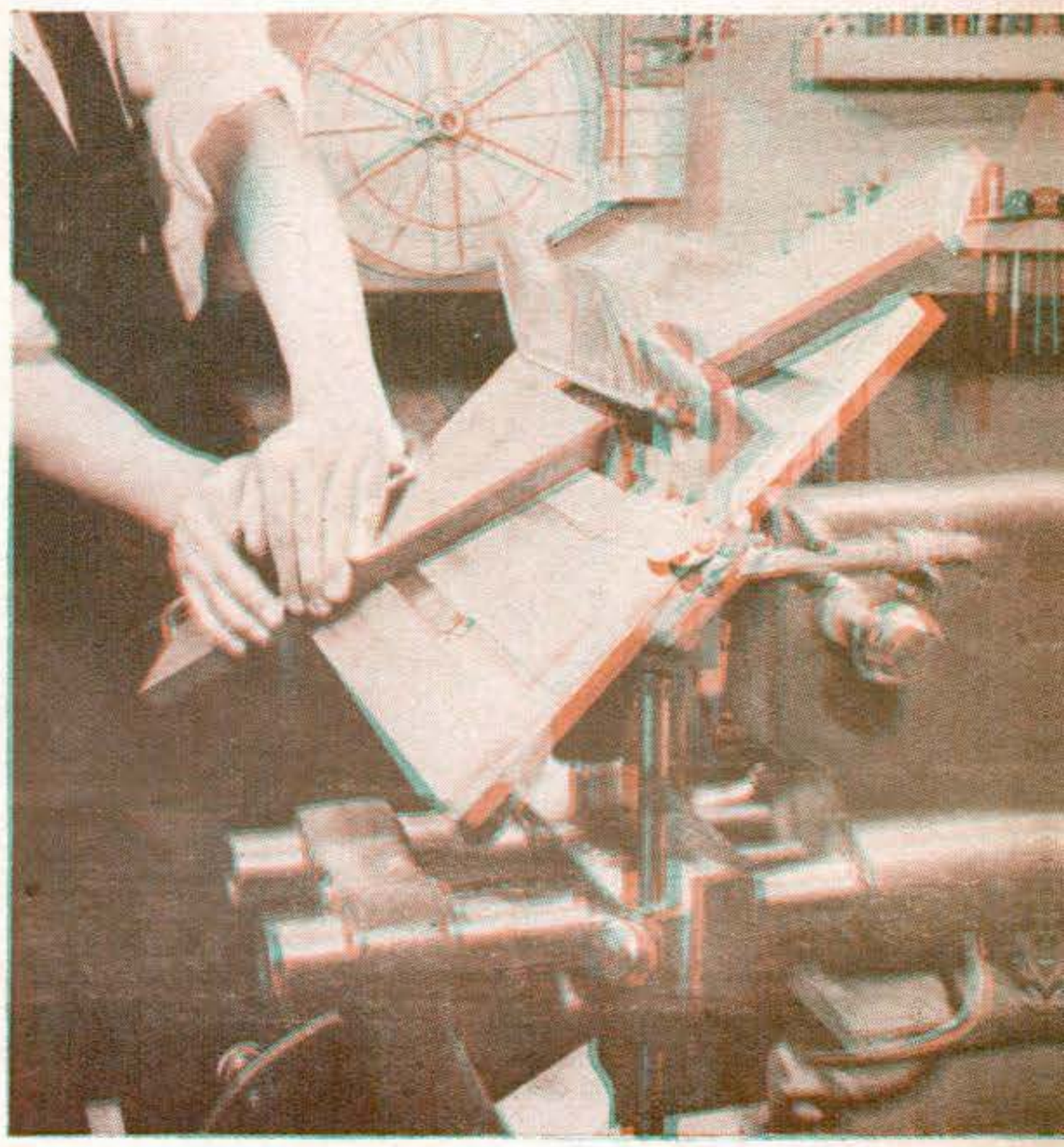
IT'S CORRECT to put the fence on the side away from saw tilt. If work must be guided against its beveled edge, turn sharp corner up. Feather board holds stock firmly against fence ahead of blade, and prevents creep and kickbacks. Splitter keeps work in line.

Copyrighted material

BETTER NOT use the fence to butt stock against for cutting to length. This dodge looks good, but chances are the cut piece will wedge itself between fence and blade. Try to prevent this by holding it with one hand as shown, and you may get your knuckles sliced.

DON'T CUT compound miters on a tilting-table saw this way. Lower end of stock will hit tool ways. The stop rod is on wrong side of miter gauge, where it cannot keep work from creeping, and will itself be in the path of the saw teeth.

BETTER DO IT this way. Clamp scrap block to fence; set to desired cutoff length from blade to block. Hold stock against miter gauge with both hands. As pieces are sawed off, they pass gauging block, and as fence is farther from blade, they can't wedge.



DO MOVE saw table to end of multipurpose tool shown, so that stock won't hit the ways. Mount stop rod on low side of miter head, where it will resist creep and be out of line of cut. A wooden extension on miter gauge head would make work easier to guide.

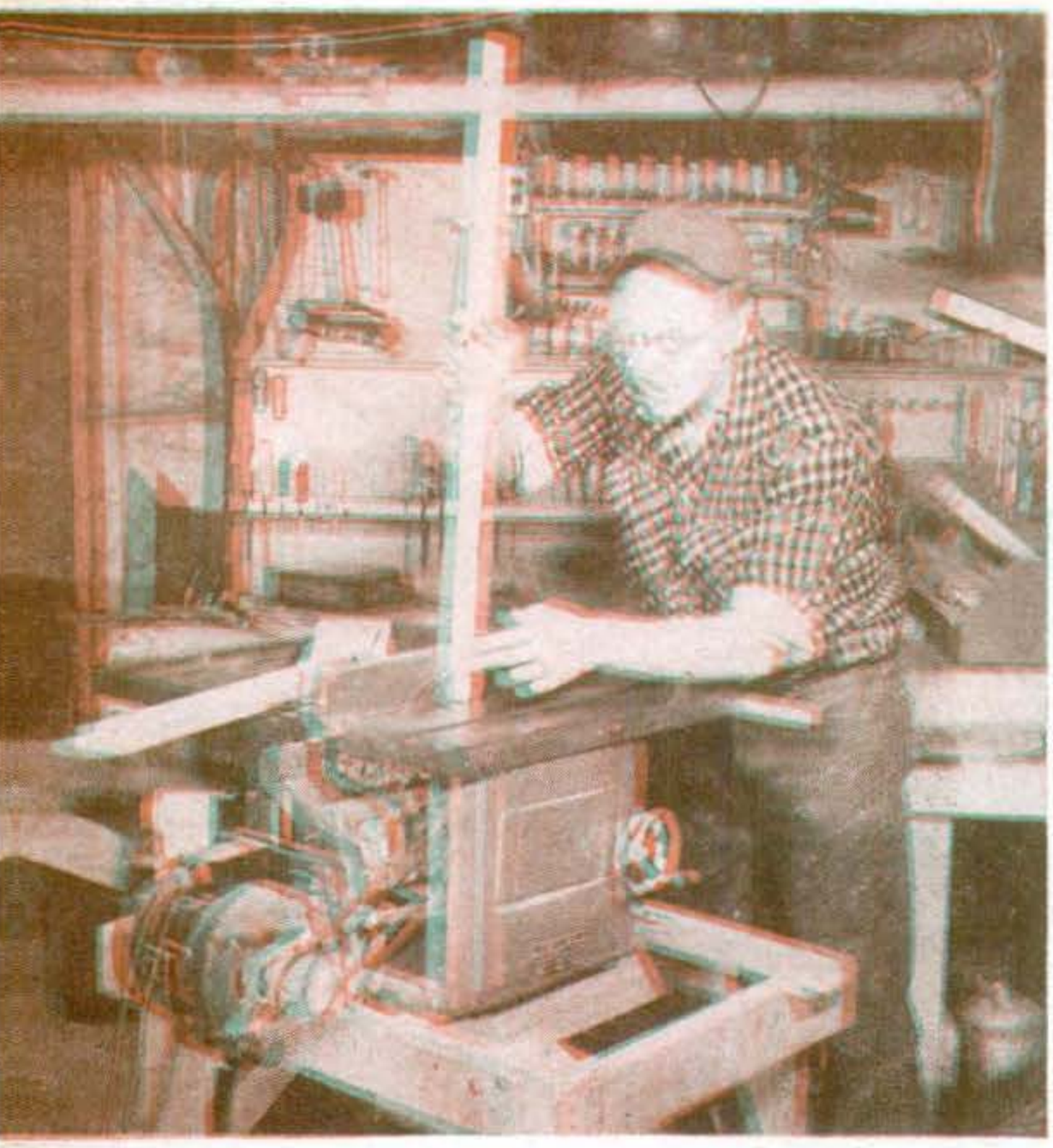
Please turn the page for more 3-D photos.

Copyrighted material

WRONG

ALL WRONG is this derring-do technique for cutting end grooves or rabbets. Upright work cannot be held true against low fence. Even if our workshopper comes off with all fingers, the cut won't be accurate.

NEVER USE a portable power saw as shown below. Its weight is sure to bend the plank, forcing kerf to wedge the blade. When it does cut through, both parts of the board as well as the saw will drop. Power cord should not be left in path of cut.



RIGHT

ALL RIGHT is a husky homemade tenoning jig like this, which slides over the fence. With work clamped to it, cut is easy and absolutely true. Blade guard cannot be used on this job; it would be in way of work.

ALWAYS SUPPORT work solidly on one side of cut, which keeps kerf open and lets cut end fall by itself. Rest heavy side of saw on supported part of work. Keep power cord and your legs well out of line of the blade, even if it has a good guard.

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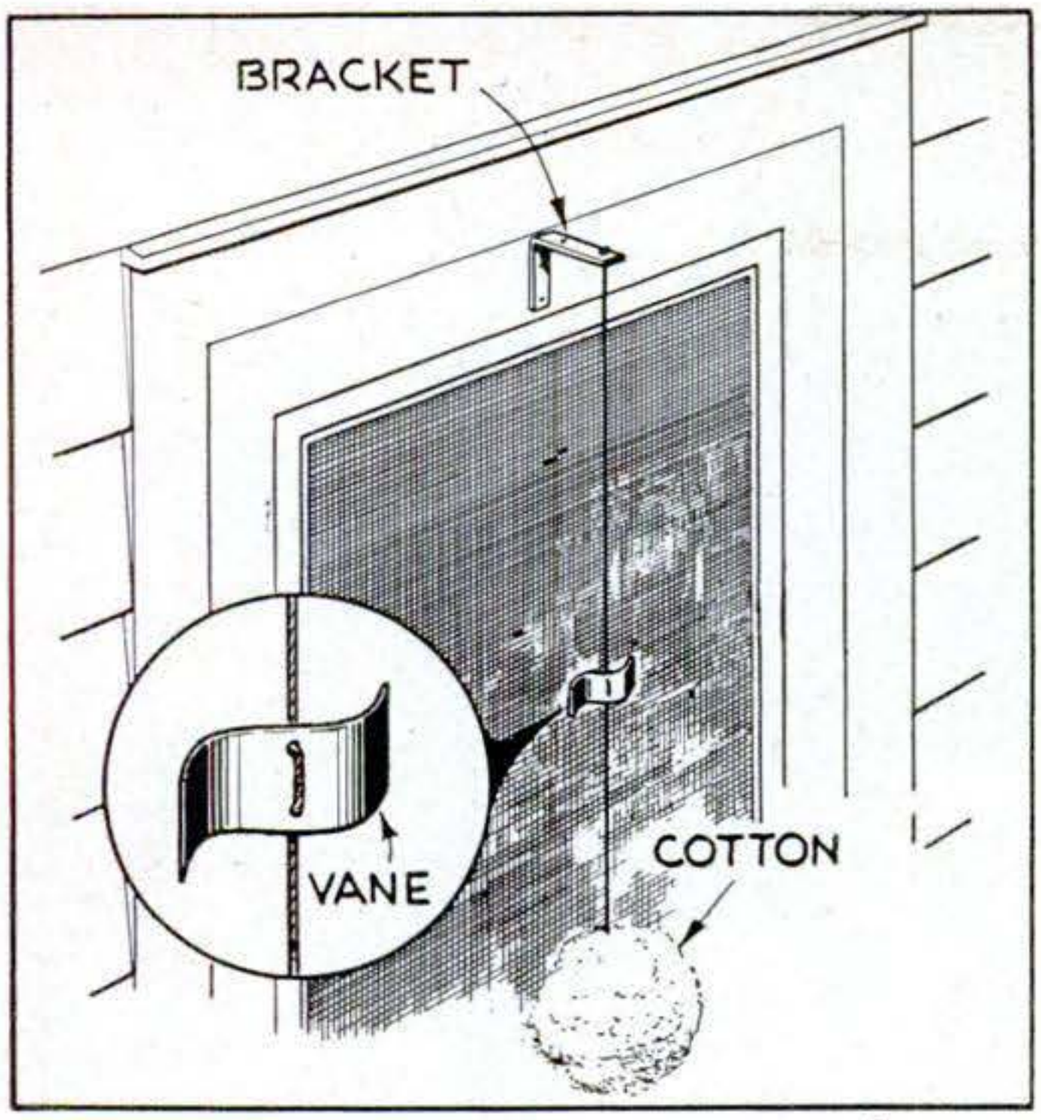
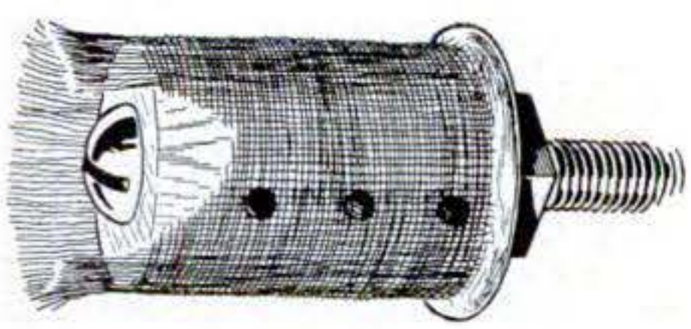
Dangling Cotton Shoos Flies



SOME people swear that a wad of cotton on a screen door repels flies. Others deny it. I say the cotton should be hung from a thread. Breezes, or the opening of the door, make the cotton swing and scare the bluebottles even if they are feasting on kitchen odors. Another dodge is to put a light aluminum vane on the thread. Any breeze makes it twist the cord up; when there is no breeze the cord unwinds. Both ways flies are foiled.—*Hi Sibley, Nuevo, Calif.*

Tire Chains Make Quick Ladder

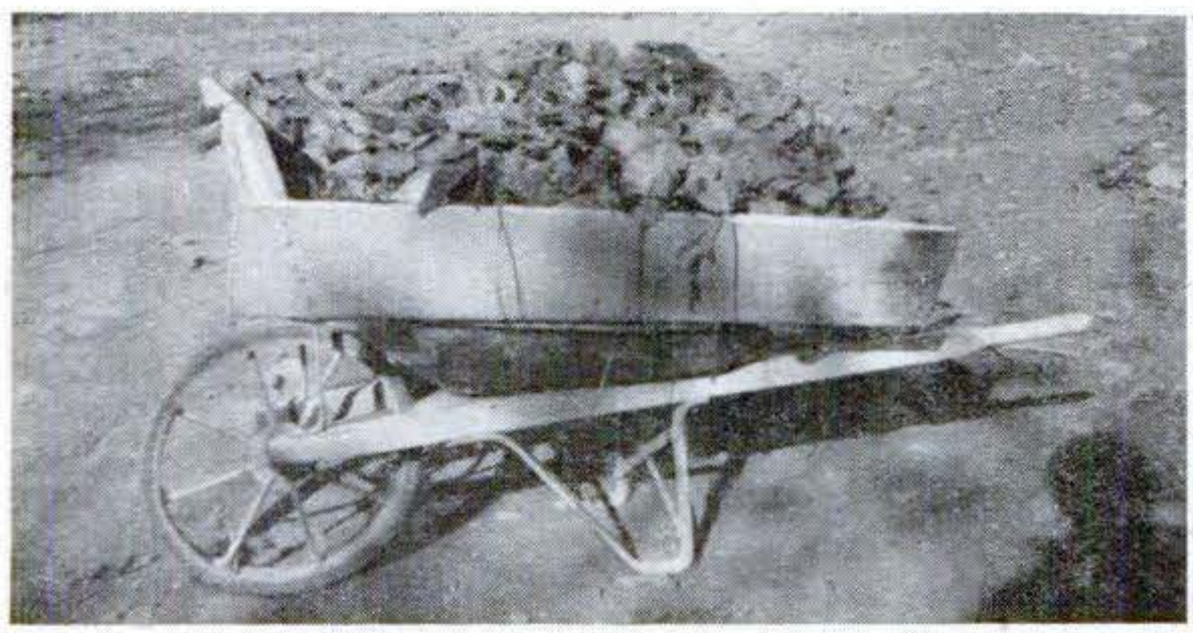
AUTO-TIRE chains make a handy ladder for garage, barn or attic trap door and can be quickly taken down when the snow flies. Narrow wood spreaders, notched at the ends, are inserted above every other cross link to hold the chains apart and form steps. —*J. R. Johnston, Dallas, Tex.*

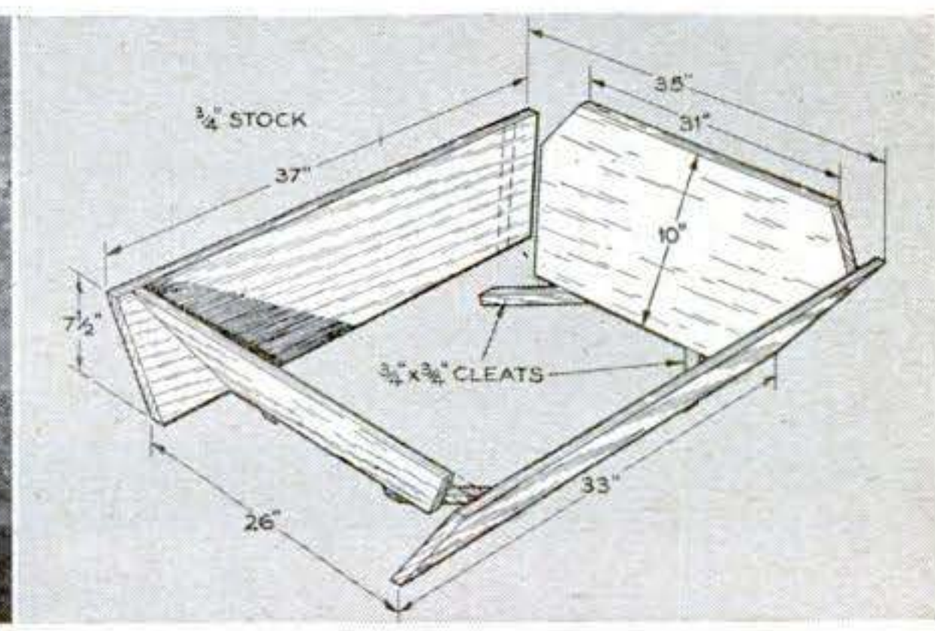


Screening Becomes Scouring Pad for Drill

CHARRED pans can be quickly cleaned with an electric-drill scouring pad. Remove one bead from a wood spool and tack on several turns of wire window screen, letting the screen overhang. A bolt held on by a nut forms a shank.

Sideboards Triple the Load of a Tray-Type Wheelbarrow





IF YOUR wheelbarrow is the tray type, you can triple each pay load of leaves or grass cuttings by knocking together a simple wood body. One built to the dimensions shown should fit most barrows. Space the cleats to hook under the rim of the tray and hold the body in position.—*John W. Aberle, Saratoga, Calif.*

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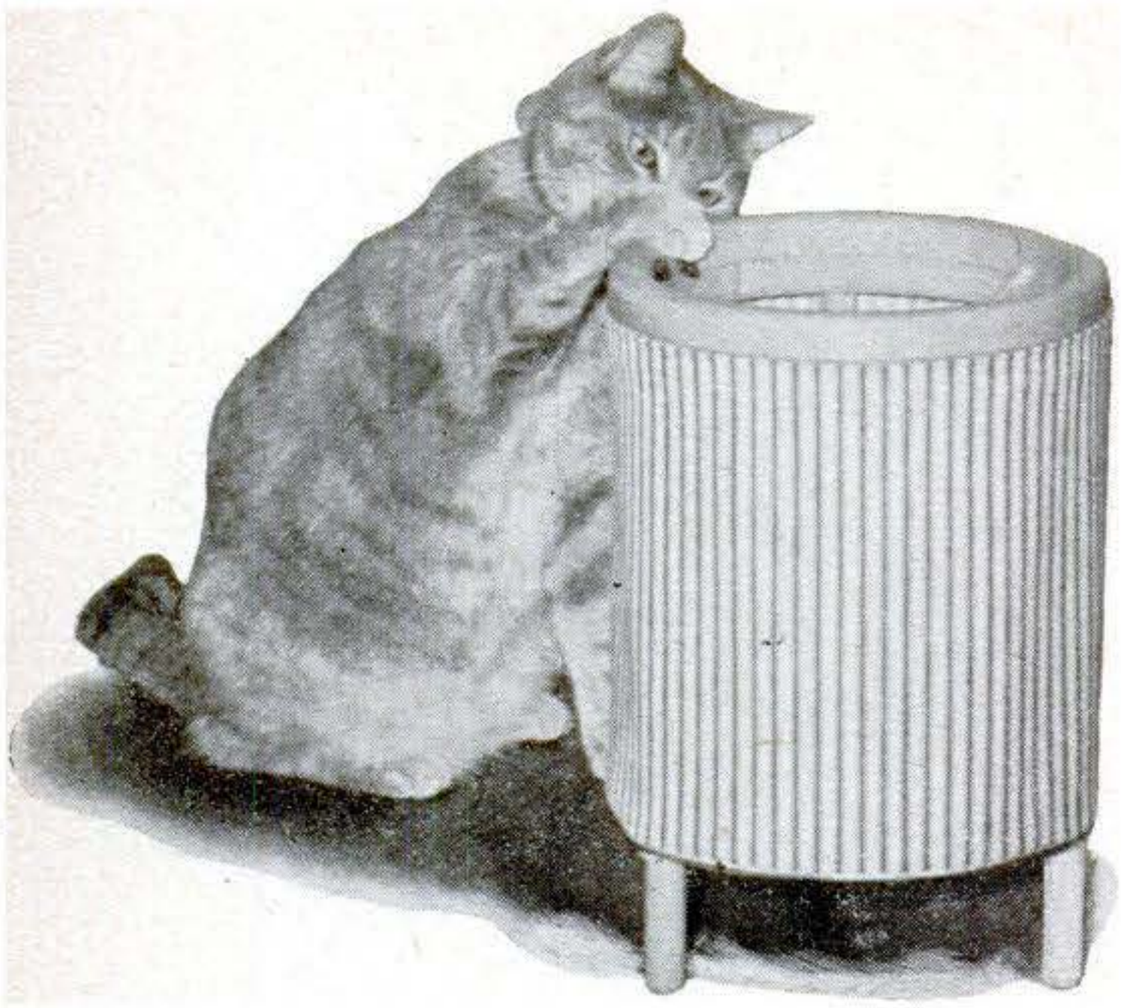
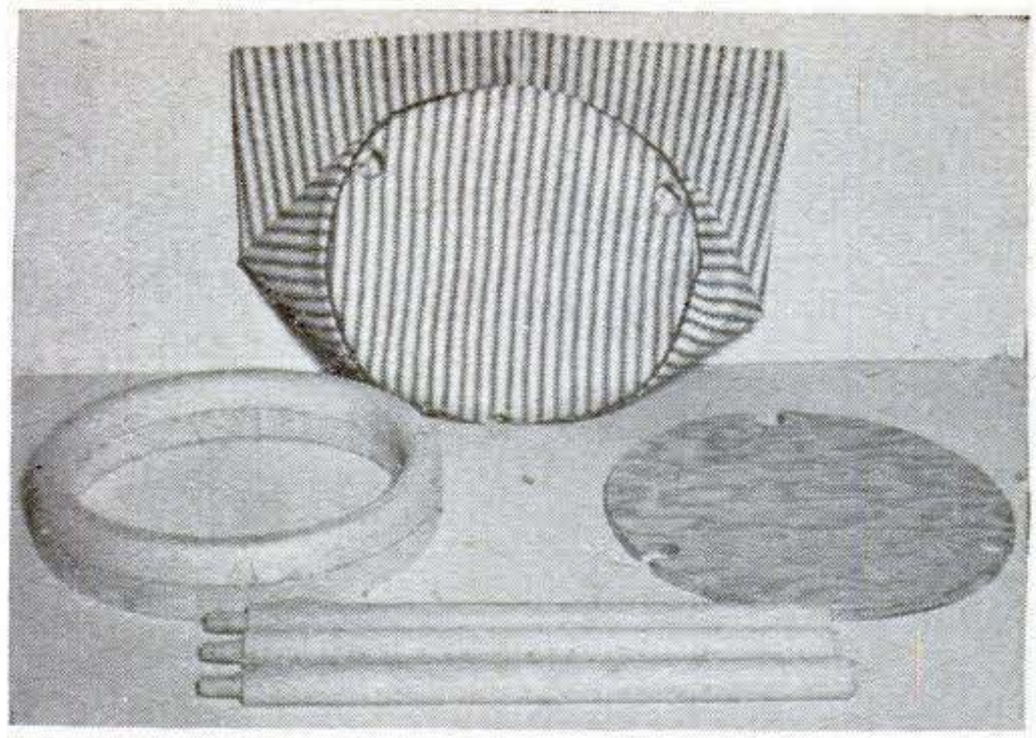


This Wastebasket Is Washable

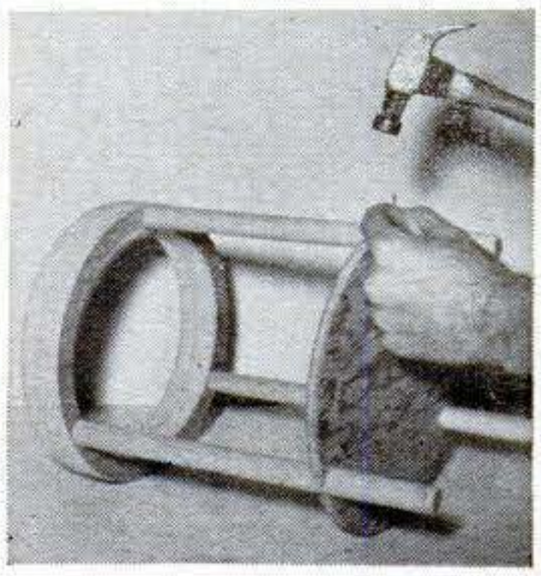
HERE'S a canvas wastebasket that can be whisked off its frame of natural-finish wood and tossed into the washer with the rest of the family laundry.

Frame. Glue the rings together so that the grain is at right angles and drill three holes in the lower ring to receive the turned-down ends of the legs. The 9″ disk of ⅜″ plywood braces the legs and serves as a hard bottom for the basket.

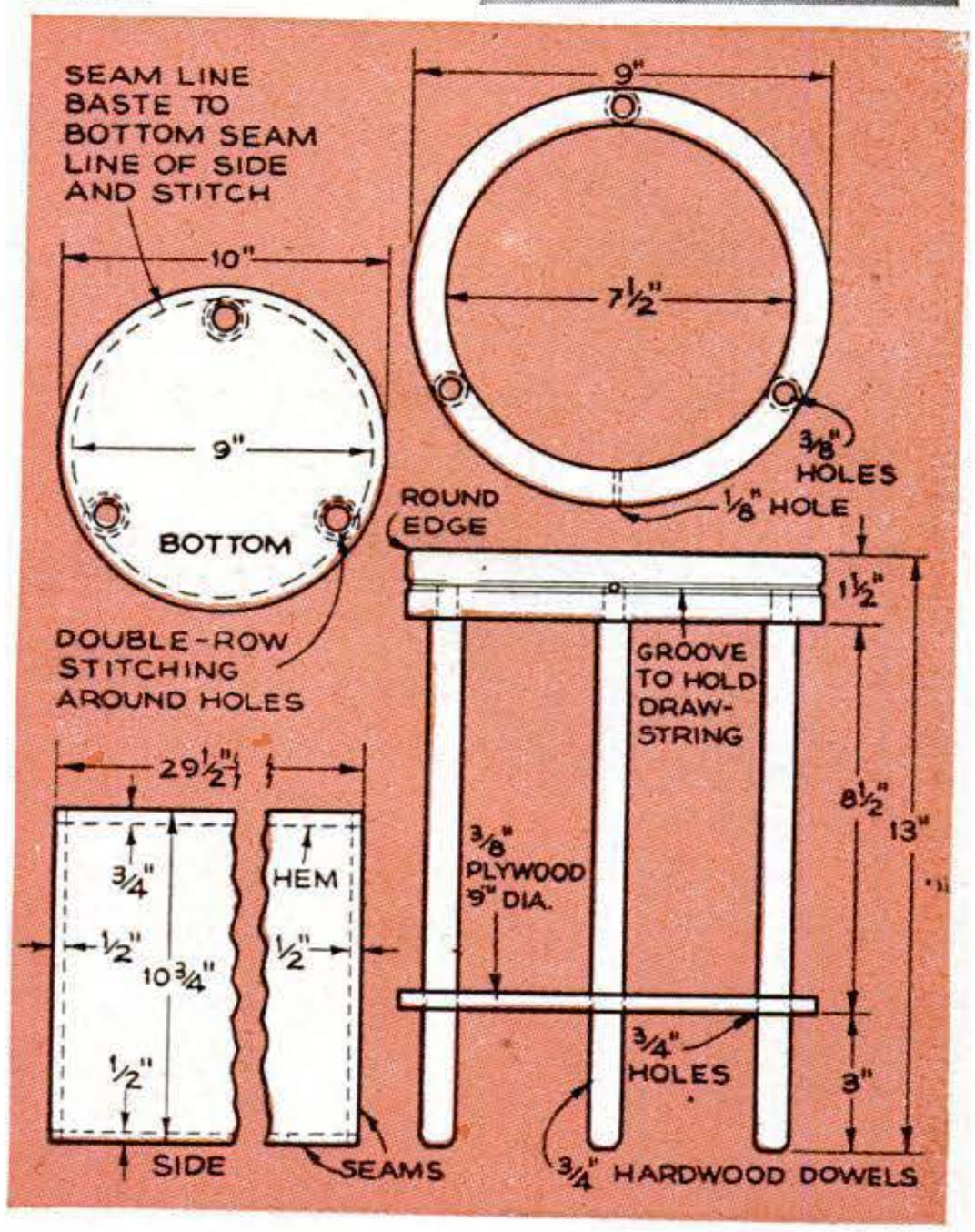
Canvas Cover. Cut striped ticking to size and stitch braid of contrasting color along the bottom edge. Fold over a top hem and sew. Baste bottom to side and sew side seam, continuing around the bottom over basting. Turn the cover right side out and insert drawstring in top hem. Cut three ¾″ holes in the bottom to fit over the legs and reinforce them with double rows of stitching. Insert the drawstring in the top hem, slide the cover over the frame, pull the drawstring through the ⅛″ hole in the ring and knot it.—*John Rogers, Dallas, Tex.*



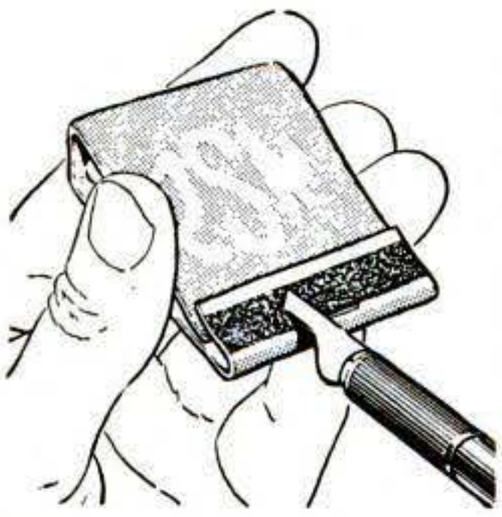
FRAME AND COVER are ready for assembly above. Hardwood dowels are turned down to ⅜″ at one end.



ASSEMBLY. Dowels are glued into ring, plywood disk is slid up on legs and held in position with brads.



Matchbook Sharpens Knife



SMALL modeling knives can be sharpened on the abrasive striking surface of a matchbook if you don't have a sharpening stone. Just rub the blade across the surface several times.

Cupboard Latches Are Hidden

MODERN knobless cupboard latches can be made by drilling small holes in the doors and mounting spring catches on the inside. Poke your finger through the hole to flip the latch.

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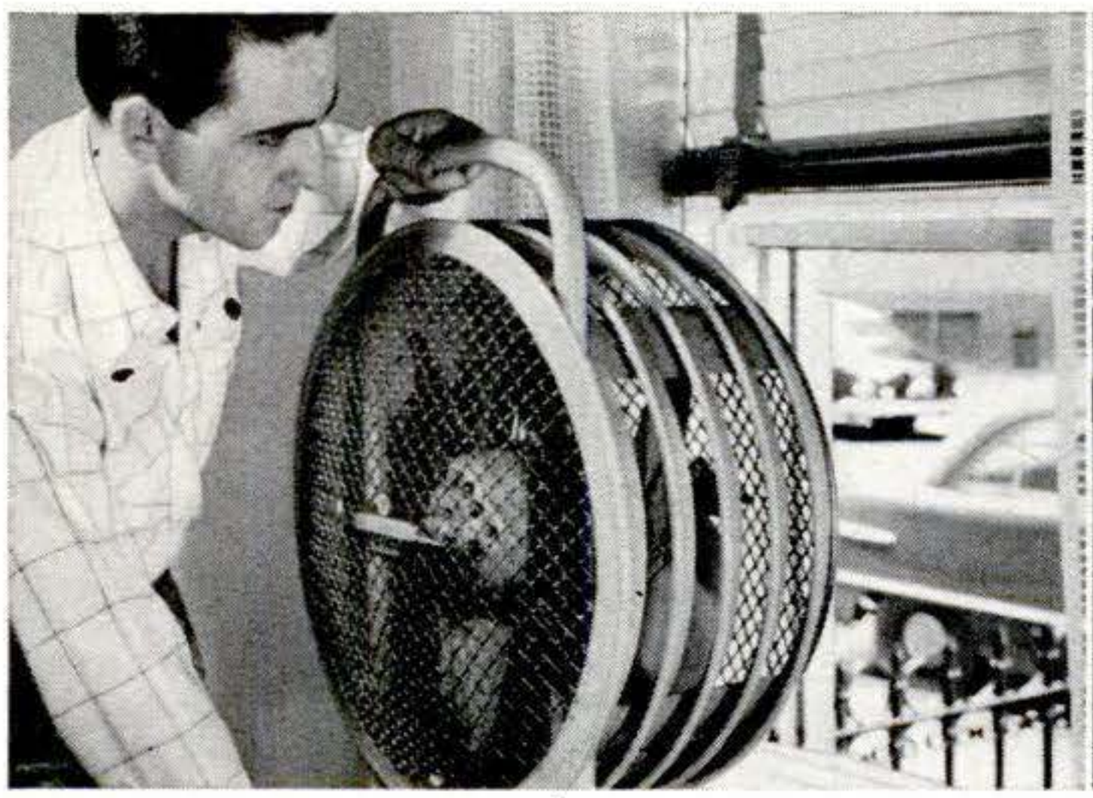
1 *When the thermometer soars, do iced drinks and cold foods make your body cooler—or are you really warmer?*

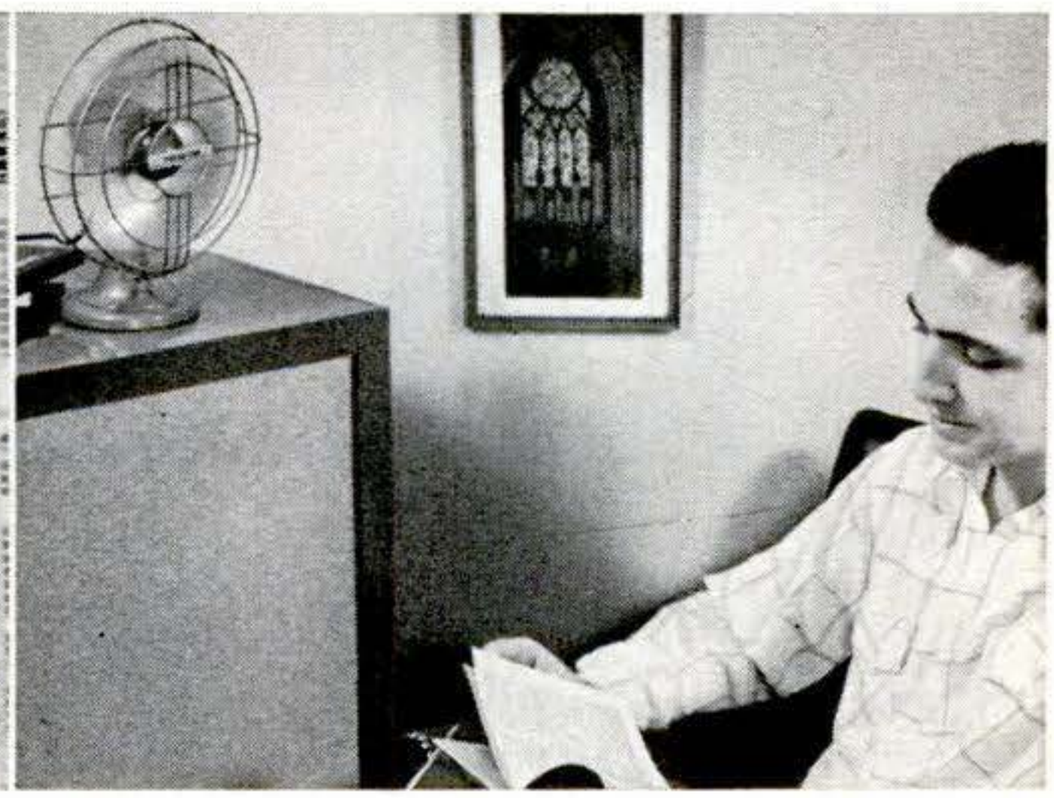
Can You Beat the Heat?

By Kenneth M. Swezey

EVER since Persian kings had slaves rush snow down from the mountains on summer days, people have been trying to beat the heat. Through the years they have found some ways that work—and some that don't. Here are popular ideas about how to keep cool. If you can answer the questions correctly, you're a long way toward knowing how to handle hot weather. Check your answers on the next two pages.



2 *Are fans that pull in air through one window and blow it out another effective when the temperature is higher outdoors than in?*



3 *Does the breeze from an electric fan cool your body directly, or does it do so by first cooling the air in the room?*

4 *Are light-colored clothes really cooler than dark-colored clothes, or is the effect largely psychological?*

5 *Will your home keep cooler during the day if you close your blinds (or draw your shades) or if you leave them open?*

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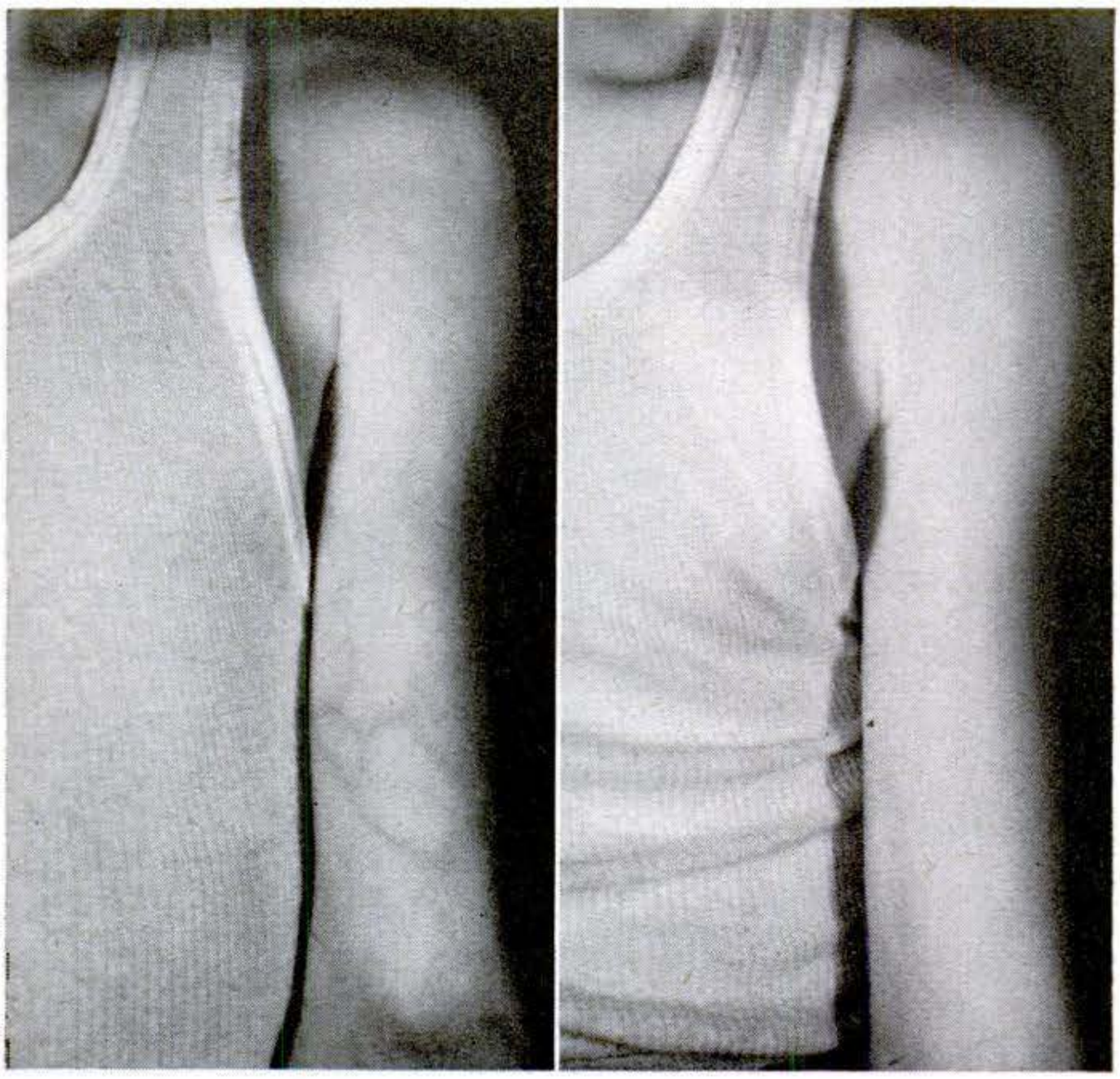
Answers to Quiz on Preceding Page Show

How You Can Beat the Heat

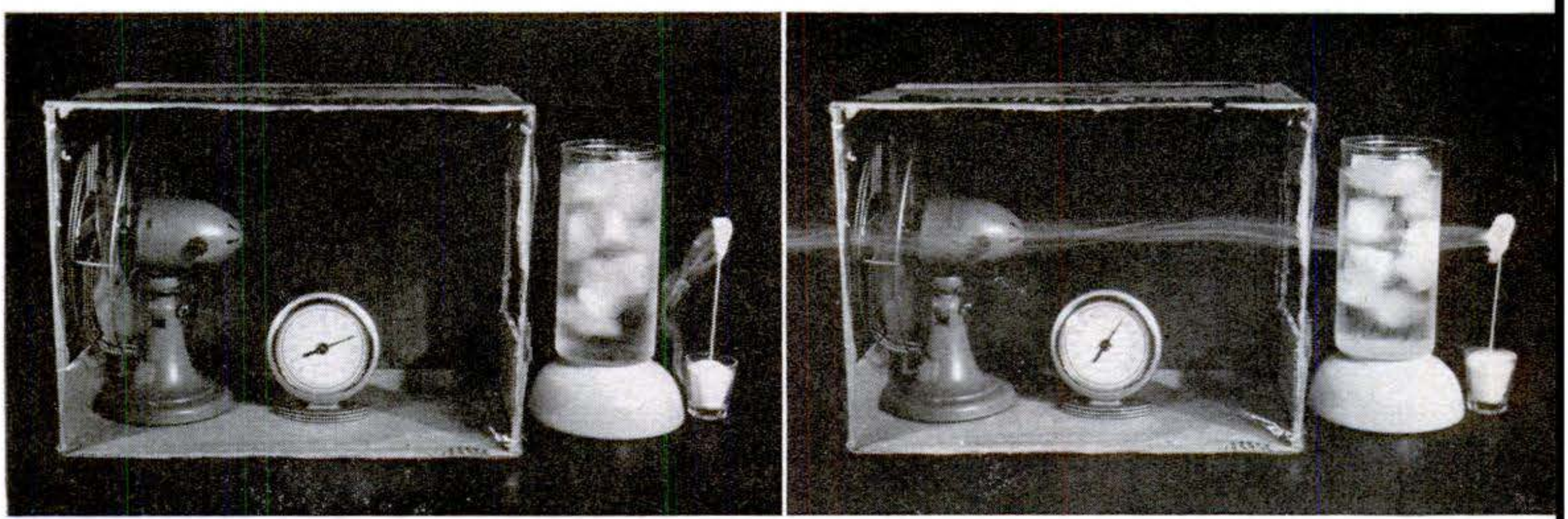


Here's the low-down on the best ways to keep cool—and some simple home experiments that show you why they work.

1 Icy food and drink may make you feel temporarily cooler, but in the long run make you warmer by lowering efficiency of your body's cooling system, as shown by infrared photos at left. In hot weather, extra blood is pumped through veins and capillaries near the surface of your skin (far left) where it is effectively cooled by radiation, convection and evaporation of perspiration. Photo at near left shows how a cold food pulls blood away from the skin surface to the stomach, where the cooling area is smaller, so less efficient.

2 Fans that pull in outside air are effective only when the temperature outdoors is lower than indoors. Otherwise you will heat your house instead of cooling it. To get the best cooling with these fans, they should be turned on after sundown, when the outdoor temperature drops, and left running until morning. During the day, the windows should be kept closed and the fans used like ordinary room fans to circulate the air that has been trapped during the night.

How such fans help beat summer heat can be demonstrated as below with a model room made from a carton with an open window cut in each end and having a cellophane side through which you can see what happens. When the fan directed out the window is not running, it is still hot within the room even when the air outside one or both windows is chilled by means of a container of ice water, as shown in left-hand picture below. Turn on the fan, however, and the cold outside air is pulled right into the room, as shown in right-hand picture below, where it quickly lowers the temperature.



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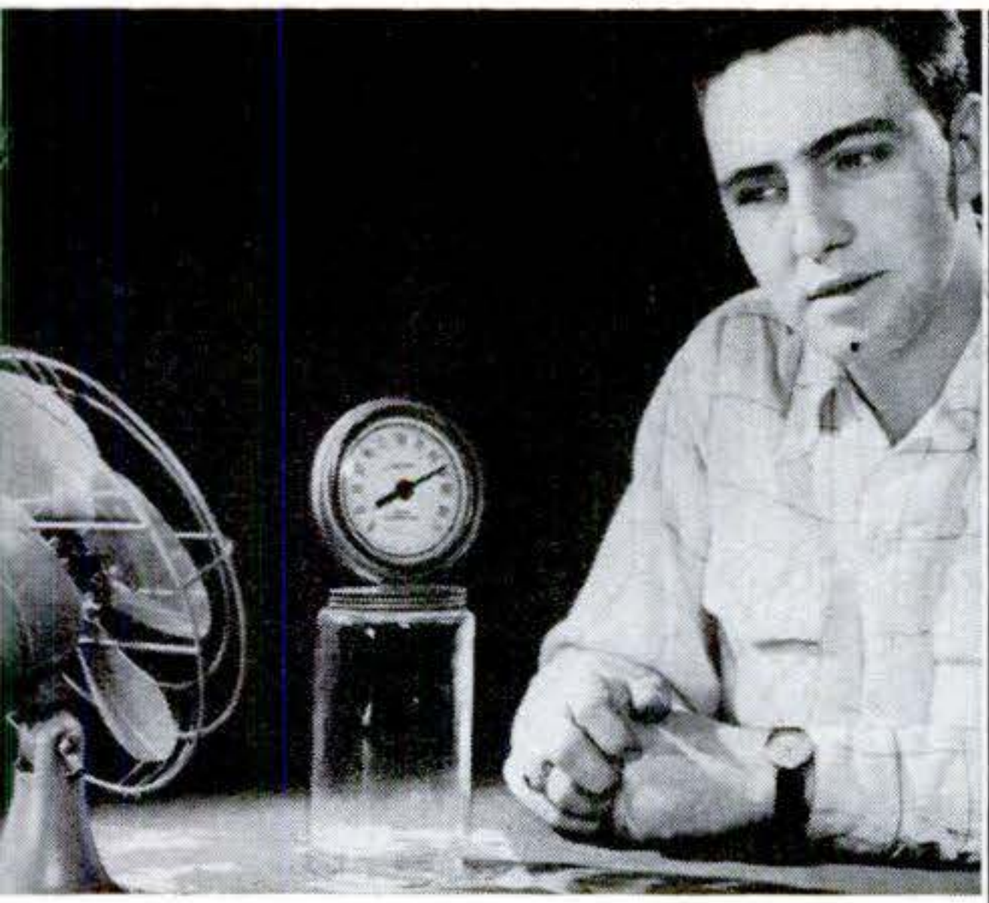
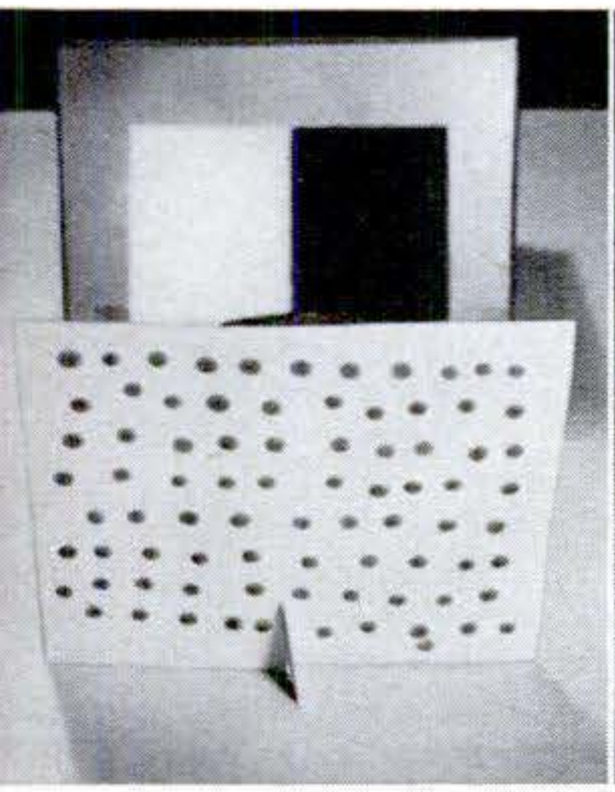
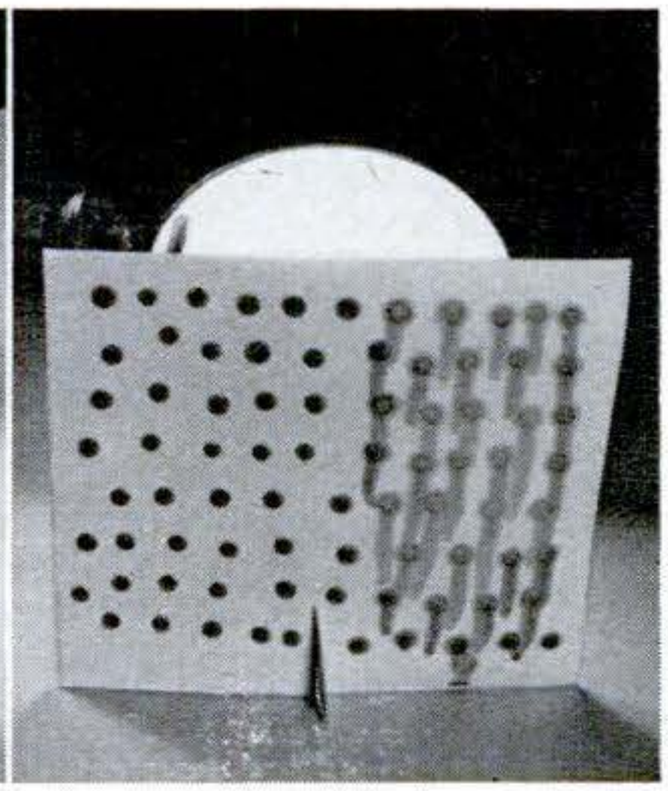


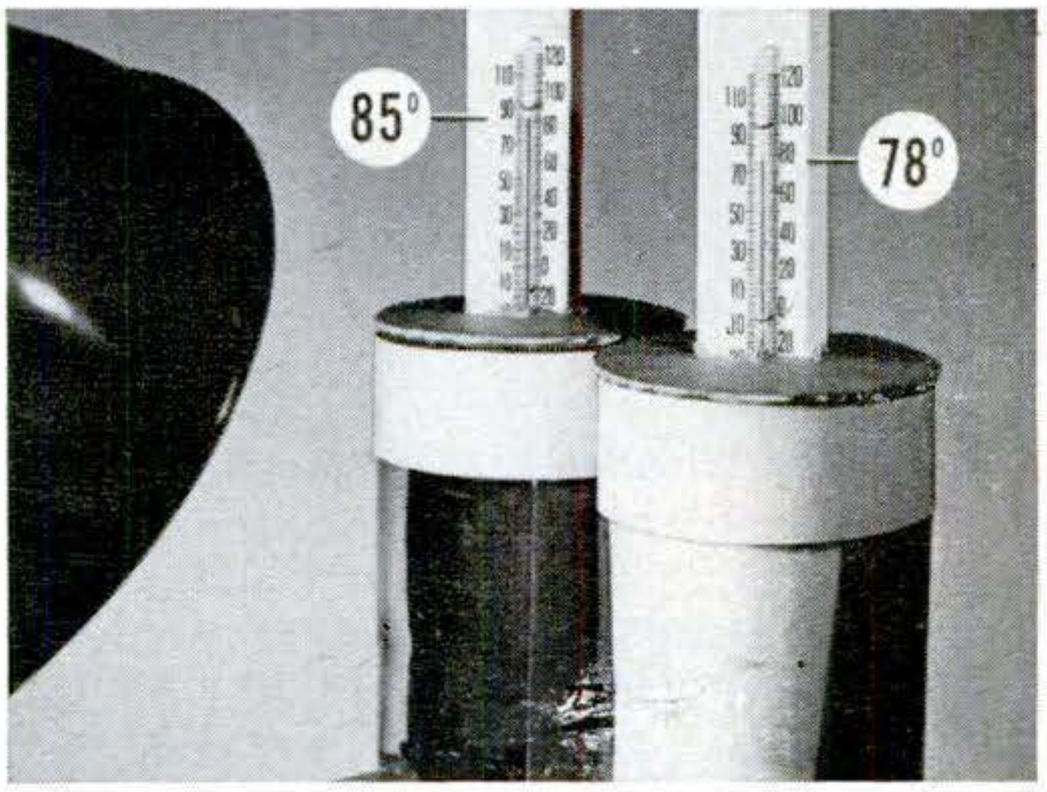
3 Odd as it may seem, the breeze from a fan does not actually cool the air in the room. It cools your body directly by carrying away heated air next to your skin and by speeding up the evaporation of perspiration. If you are skeptical, here's a stunt that will prove it to you. Set up a thermometer between a still fan and you, as shown in the left-hand picture above. Then turn on the fan and watch the thermometer. As shown in the right-hand picture above, the reading on the thermometer does not drop a single degree even though the breeze from the fan makes you feel much cooler.

4 Under direct sunlight or intense artificial light, light-colored clothes are cooler than dark-colored clothes of the same material because they absorb less radiant heat. Here is a simple test that demonstrates the principle involved. Blacken half of one side of a sheet of thin white cardboard, as shown in the mirror reflection at left below, and dot the other side with drops of candle wax. Prop this sheet on edge and direct the light from a photoflood bulb in a reflector toward the black and white side of it. The heat absorbed by the black section will quickly melt the dots opposite it, while the dots opposite the white section will still be firm, as in the picture at right below. Incidentally, this is true only under direct light. Some experts believe that in the shade white clothing is really hotter than black because it slows the radiation of your body heat, an essential part of the process by which your body tries to keep cool.

5 Your house will stay cooler if you close the blinds in windows that face the sun. When radiant heat comes through the window glass, it is absorbed by walls and furnishings. But they are heated to such low temperatures, that they cannot radiate much heat back through the glass, so much of it heats the room air. You can demonstrate this "greenhouse effect" with the two glass jars shown below, two-thirds lined with dark paper to represent the walls of a room. The "window" left by the gap in the paper is closed in one jar by a light paper "shade"; in the other, left open. Thermometers are inserted through slits in the cardboard covers, their bulbs shielded from direct light by paper around the jar tops. The air temperature in both of the jars starts the same. But when the light is turned on, the temperature in the jar without the shade climbs much faster than it does in the jar where the radiated heat is blocked at the window. END







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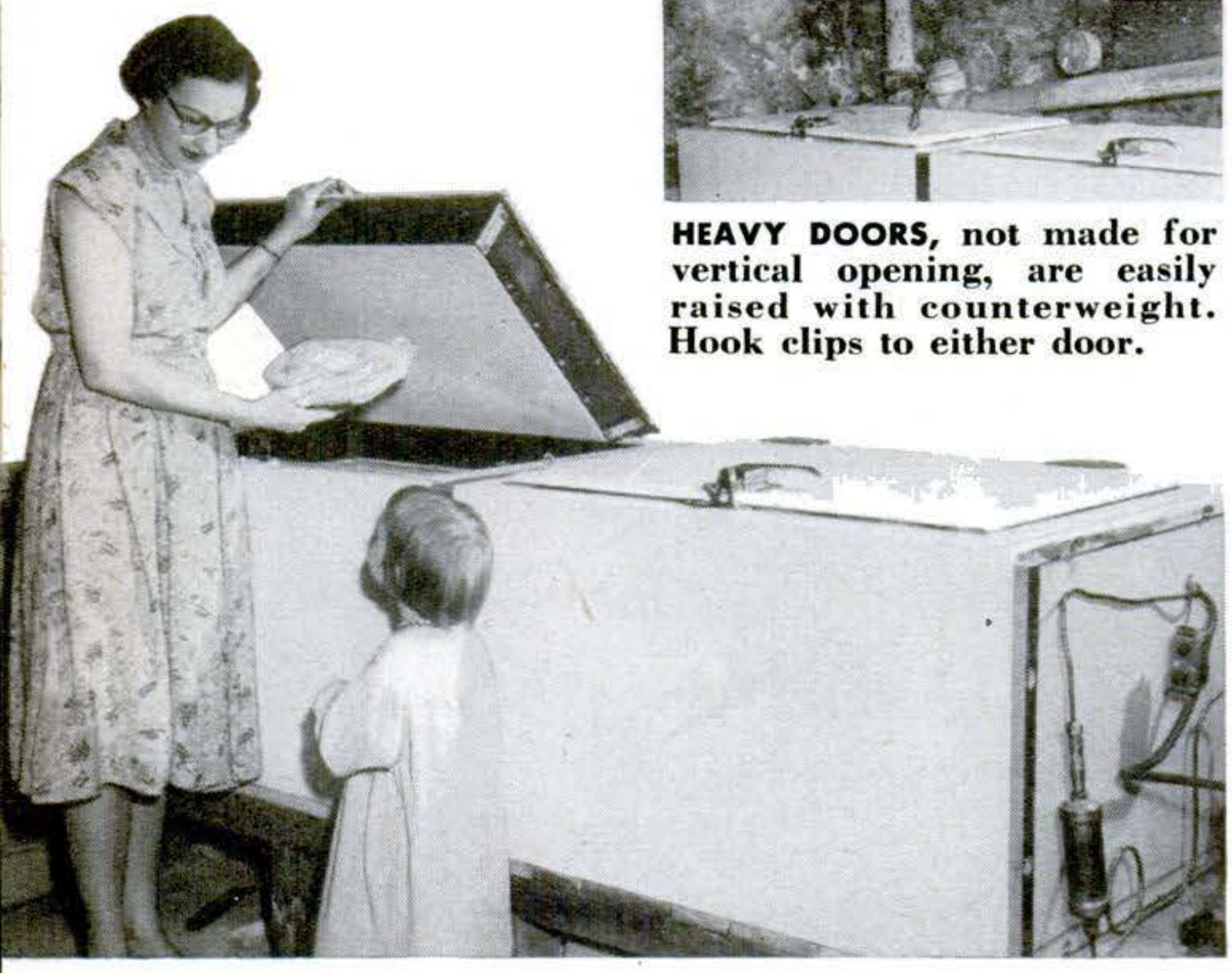
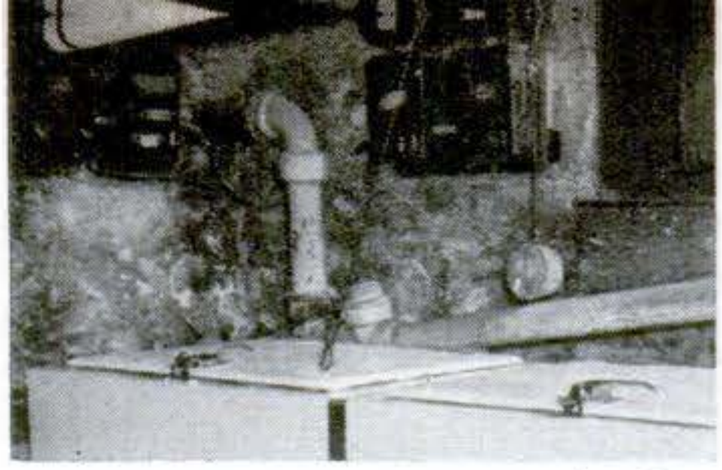
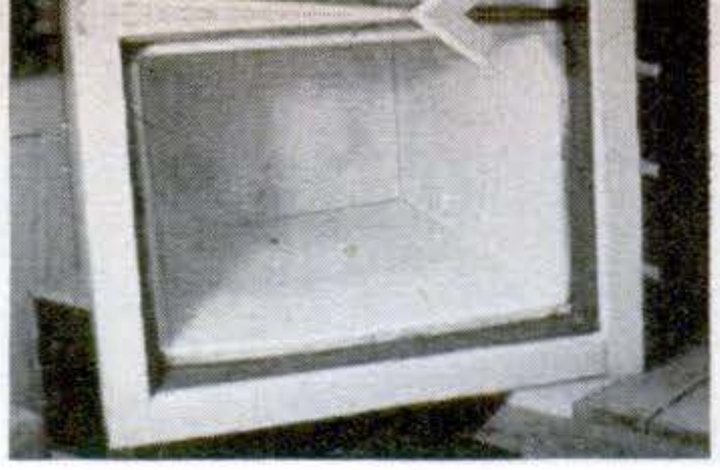
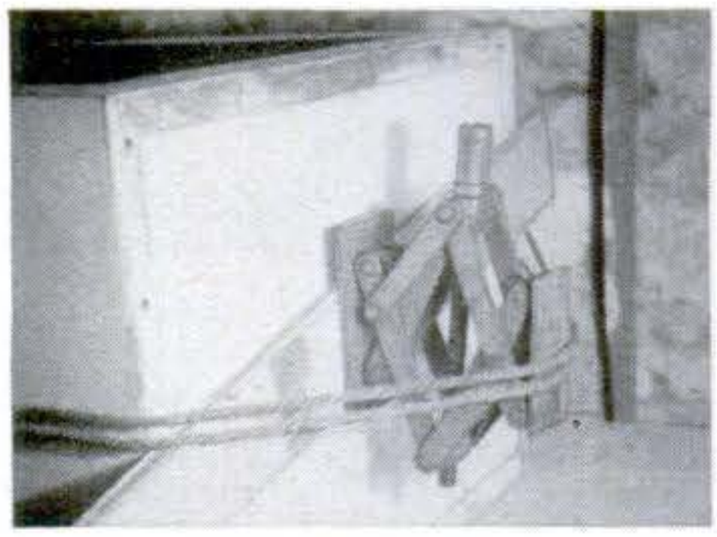




HEAVY DOORS, not made for vertical opening, are easily raised with counterweight. Hook clips to either door.



JOINT BETWEEN BOXES was made airtight with strip of ½" sponge rubber cemented to one edge. Inside seam was covered with Fiberglas for insulation where boxes had none.



AUTO JACK and looped cables were used to squeeze boxes tightly together for joining. Then seam was covered with steel strap, put on with self-tapping screws.

How I Built My Food Freezer

Two old refrigerators, bought for $1 apiece, keep 450 pounds of eats at a chill 4° above zero.

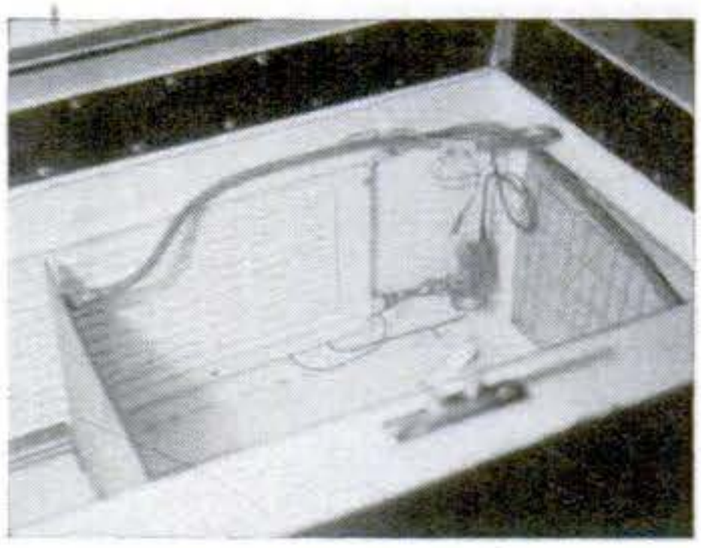
I WANTED a freezer, but the size I needed they don't sell in dime stores. Now, by combining two old refrigerator boxes and some secondhand parts, I have a 13-cubic-foot freezer that'll hold 450 pounds of eatables. The kids can have ice cream in August and strawberries in January, and if anyone ever sends me a steer I'll know just where to put it. For about $80, I figure I've got a freezer that equals a $400 commercial job.

Joining the boxes. These are two junked 6.4-cubic-foot GE refrigerators, laid on their backs with the tops removed and the open ends facing. The photos show how I lashed them together with steel strap and a jack.

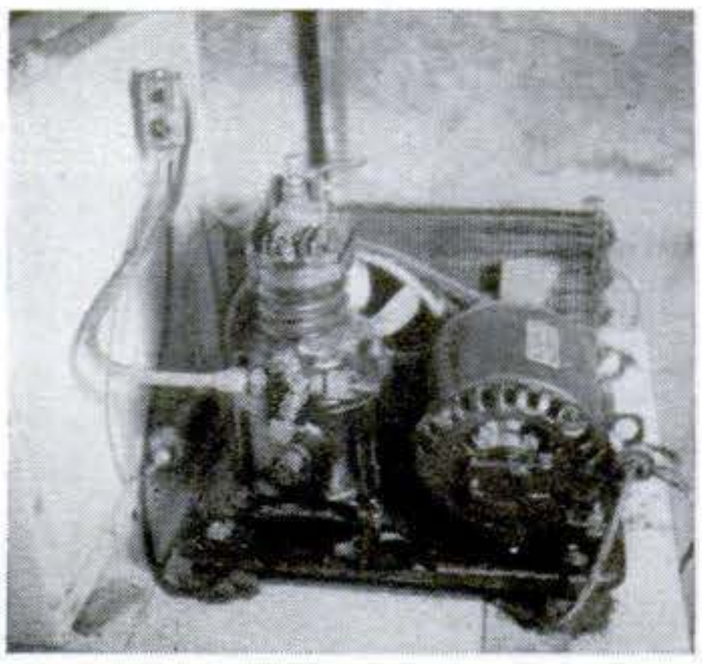
Some boxes come with a flange on top that makes them hard to join, so I made sure to get two with flat edges. To make the doors open on the same side, one had to be reversed. I then mounted the boxes on a wood frame, about 14" high, to bring the top of the freezer up to 36". This makes it easy to reach in without bending.

Hooking it up. A ¼-hp. motor drives the compressor to circulate the Freon. From the compressor I ran ¼" tubing to the receiver tank and from there to the expansion valve that sprays the Freon into the freezing plates.

The system was charged with about three pounds of Freon by pumping a vacuum and letting it draw the Freon in. Temperature is controlled by an old bellows-type pressure valve that keeps the chill down to about 4° above zero.—*Leon Levine, Brooklyn, N. Y.*



FREEZING PLATES and expansion valve (in corner) are only new parts, cost about $50. Plates were bought to nearest size, then screwed to inside of freezer on all sides.



COMPRESSOR, motor and condenser (in background) came from old refrigerators, cost $5 in all. Thermostat on box (upper left) sounds warning buzzer if temperature rises.

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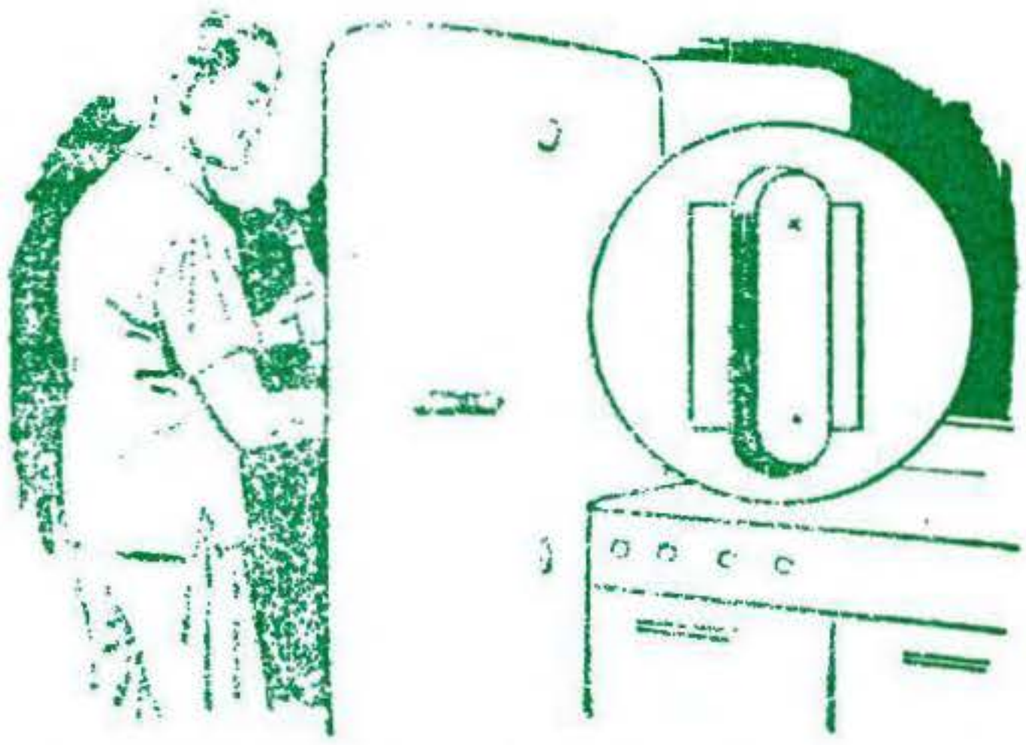
KEEPING THE *Home* SHIPSHAPE

ADD A PAPER GRIP to the arm of your chair so you can read outdoors without sprinting over the lawn on windy days. Spring-type screen-door catch will do the trick.

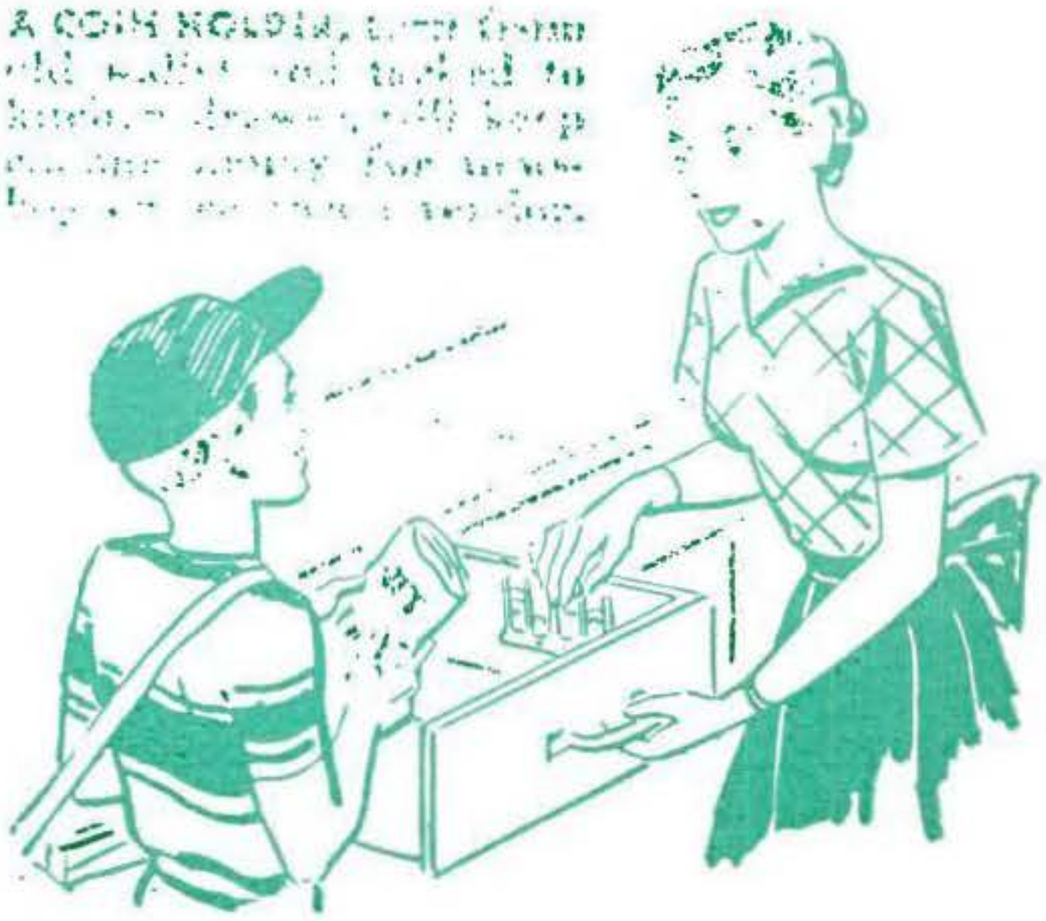
AT CANNING TIME, hoard emptied king-size cereal and soap boxes. Taped to a counter edge, one of these will hold lots of swept-off peelings.



IF IT MEETS INTERFERENCE when opened, a refrigerator door can be protected with a rubber toilet-seat bumper cemented to an adhesive-type picture hanger.

A CREEPING CUTTING BOARD slows down salad makers. Rubber washers cemented at each corner will hold the board steady and keep it from marring work surfaces.

A COIN HOLDER, made from old bottles and tacked to kitchen drawer, will keep coins handy for urgent buys at the door or two-cents.



Please turn the page for more new ideas.

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More Home Tips

CHECK RADIO OR TV DIN during open-window season. Paint a dot on the cabinet and the dial after tuning the set while an outdoor listener checks and okays volume. Then you'll never blast at neighbors.

A DUST BOX under your kitchen floor is handy for sweepings. Cut a tile-size trap door in a corner. Pivot it to open with pressure.

A SLIDING TRAY, made like an egg crate and riding on record-player tracks, is handy for bottled drinks. Fit it to the cabinet nearest the refrigerator.

TOO FAR TO THE ALARM CLOCK? If there's no room for a bedside table, mount half a chopping bowl over the bed. Add a top cut from thin board and hang as shown.

BEFORE ANCHORING POSTS in wet cement, dunk the ends in linseed oil and give the wood plenty of time to expand. This prevents cracking of cement, retards rotting of posts.

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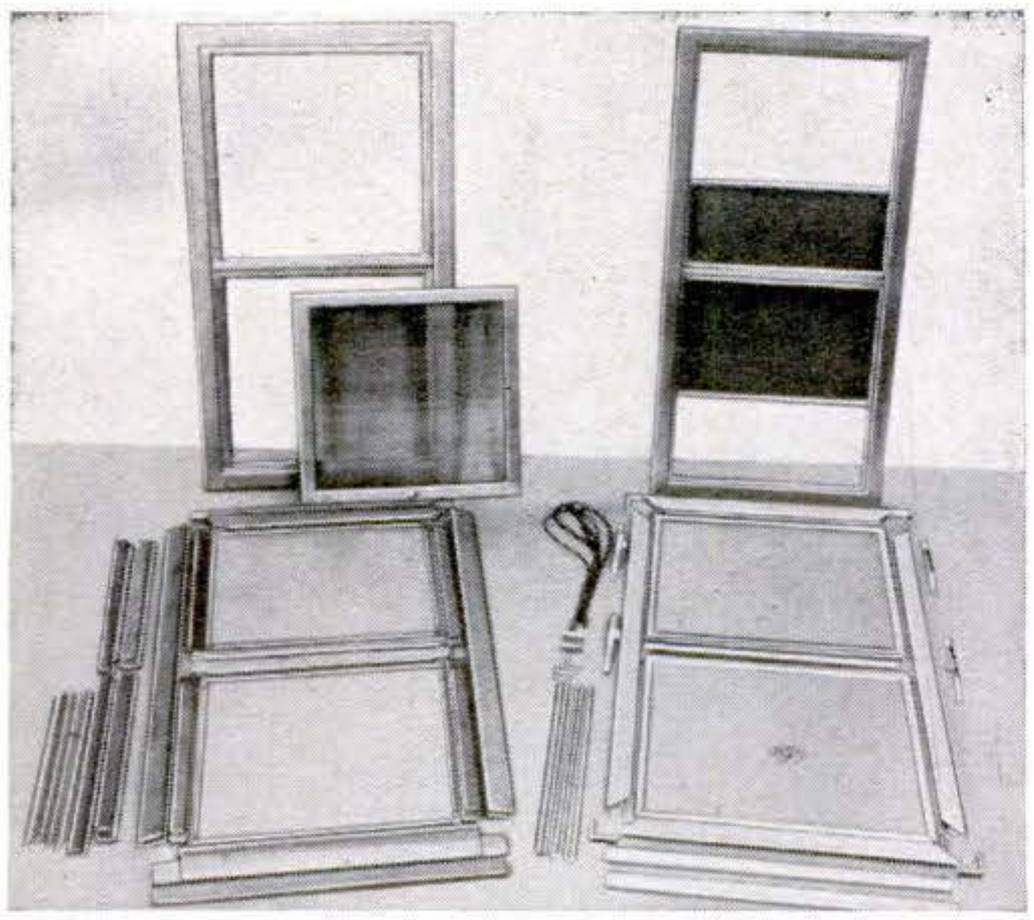
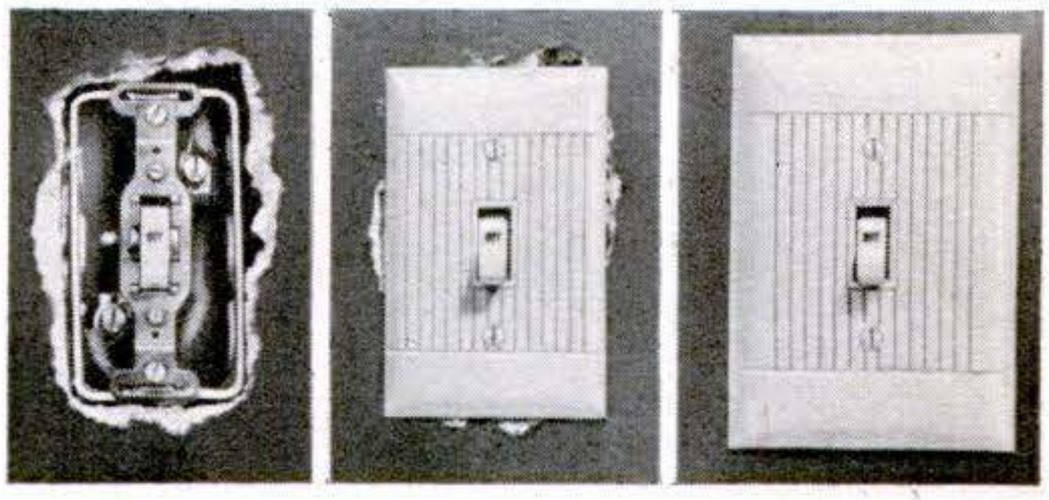
Handy Man

1. Colored Blocks Need No Paint. You can now build a wall in color. Precolored concrete blocks are already finished for you with a hard, bright, washable coating that won't crack, mar, mildew or let moisture through. The finish comes in 20 colors in either a smooth gloss or a rough texture that helps deaden sound. For interior partitions, you can get blocks that have a different color on each side.



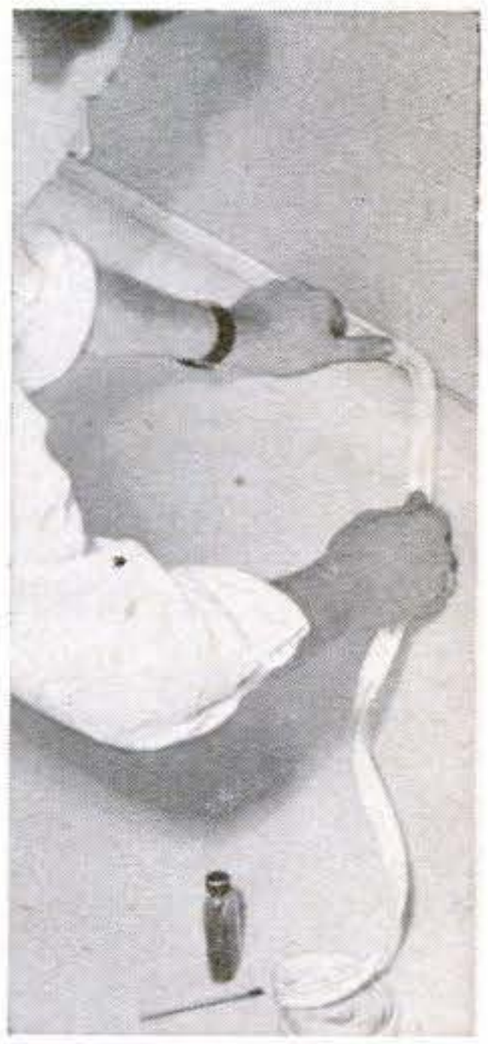
2. Storm Sash Comes in Kits. You supply only the glass and screen to make these combination storm-screen units. Everything else needed—frames, fasteners and hardware—comes knocked down, ready to assemble with a few tools. The frames are available in both redwood and aluminum, and come in standard sizes.

3. Tints Match Paint. You can have rubber-painted walls, glossy woodwork, enameled cabinets, a flat-oil ceiling and painted masonry—all exactly matching — with these new tinting colors. The colors will mix with any paint—water, rubber, oil, alkyd-resin, varnish and cement—and are simply added in equal amounts to a white base to get duplicate shades.



4. Switch Plate Hides Plaster. Broken plaster around an outlet box that isn't covered by an ordinary switch plate can be easily hidden with this special large-size plate (right above). The 3½″-by-5½″ plastic plate comes in ivory and brown, takes standard mounting screws, and is also made in a double-socket type.

5. Strip Seals Tub. Cracks around bathtubs, sinks and other plumbing fixtures can be quickly made watertight with this flexible plastic strip. Cemented in place, it forms a smooth, concave joint between wall and fixture, shedding water so it can't collect at the crack. It comes in 15′ lengths with separate elbows and end pieces for fitting corners and edges.



Further information on these products can be obtained from: 1. Sherwin-Williams Co., 101 Prospect Ave., N. W., Cleveland 1; 2. Buckeye Screen and Weatherstrip Co., 1378 So. 22nd St., Columbus 6, Ohio; 3. Keystone Paint and Varnish Corp., 71 Otsego St., Brooklyn, N.Y.; 4. Sierra Electric and Mfg. Co., 544 E. 31st St., Los Angeles 11; 5. The Leonard Co., Des Moines, Iowa.

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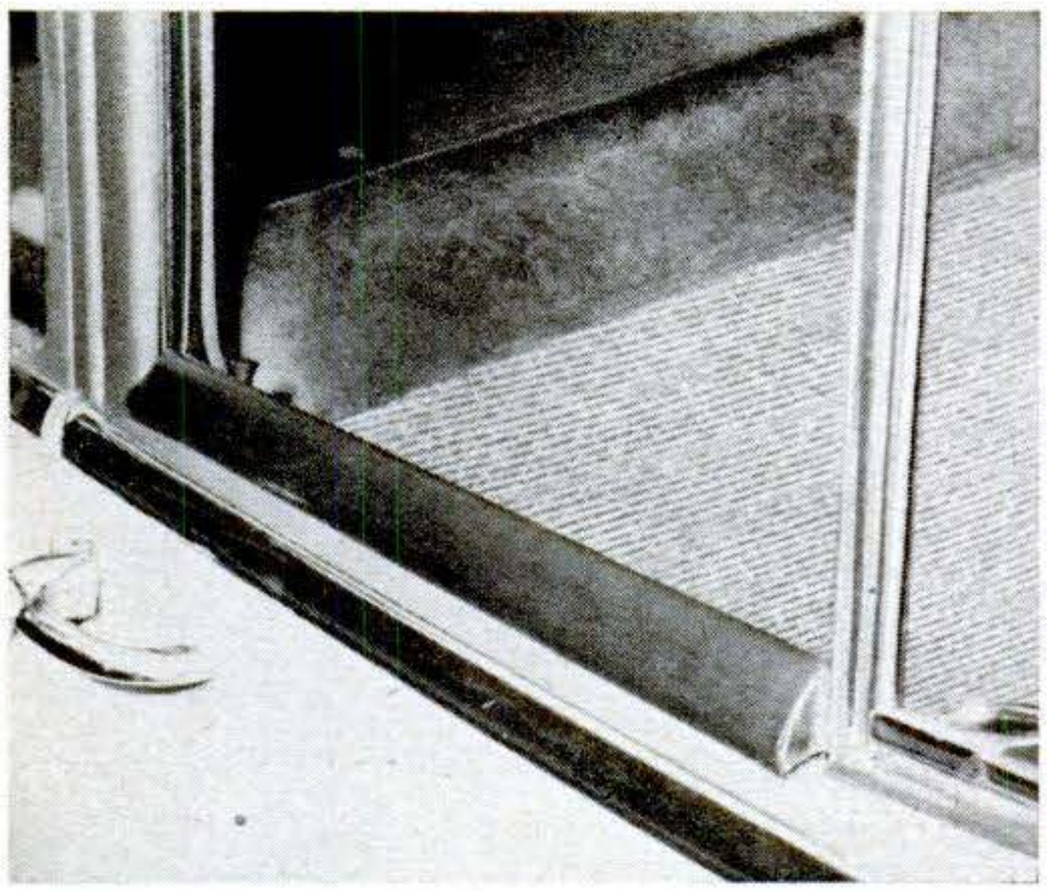
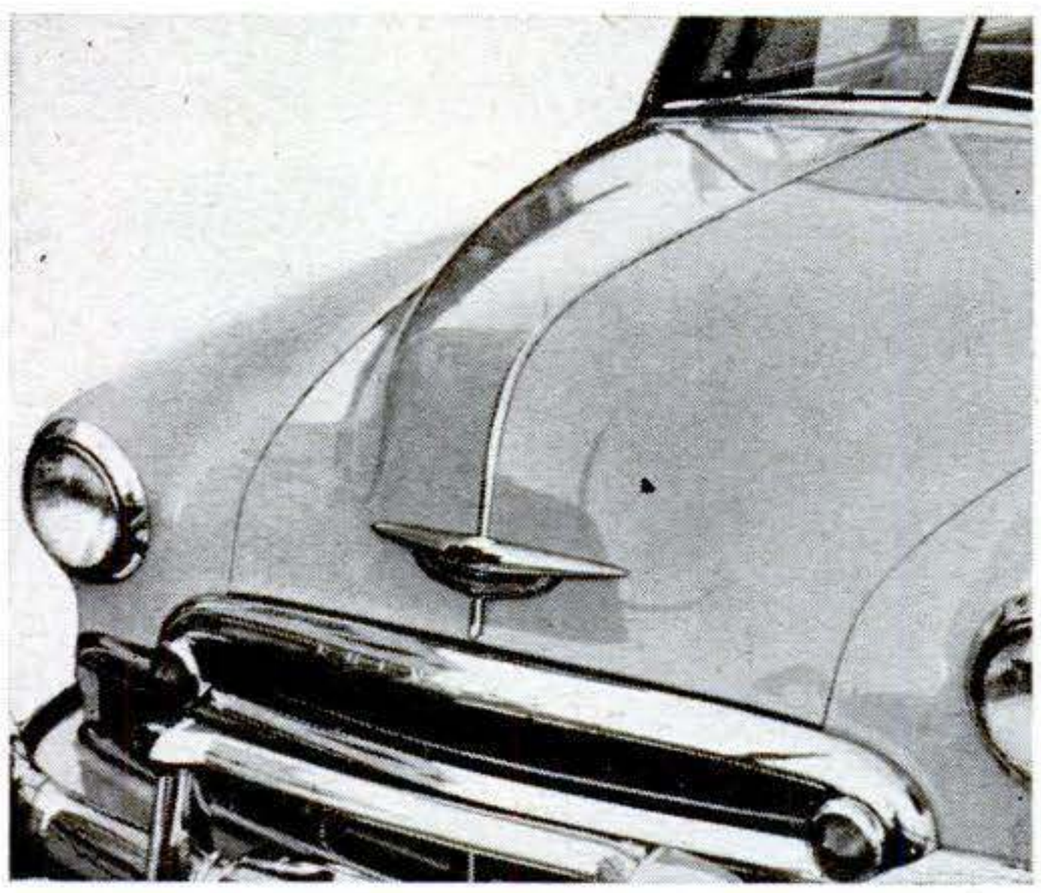
New for Your Car

1. Sleeping Tent Hooks to Car. Taking up little room in the luggage compartment, this canvas shelter can be set up in a couple of minutes to serve as a picnic shelter or for overnight camping. One side hooks to the car's rain gutter, while the other is held by aluminum poles and guy lines. At night, three side curtains roll down and zip together to form a two-cot sleeping tent. By adding extra poles, you can make the tent stand by itself so the car can be detached for trips away from camp.



2. Squeegee Seals Car Window. Quickly mounted outside a side window, this accessory acts as a squeegee when the window is raised or lowered, serves as an arm cushion when the window is open, keeps the window from rattling, and seals out rain and drafts. Called "Windomatic," it consists of rubber attached to a stainless-steel mounting strip. Two sizes adjust to fit any window. As a squeegee, it cleans the glass when the window is raised or lowered.



3. Molding Gives Custom Look. Chevrolet owners can give their cars a bullnose look with little effort. This customizing molding goes on in place of the original unit without welding, drilling or cutting. Made of polished stainless steel, the molding extends from windshield to grille and can be used either with or without the Chevvy insignia. The accessory fits any Chevvy from 1937 on. A similar customizing unit also is available for late Fords.

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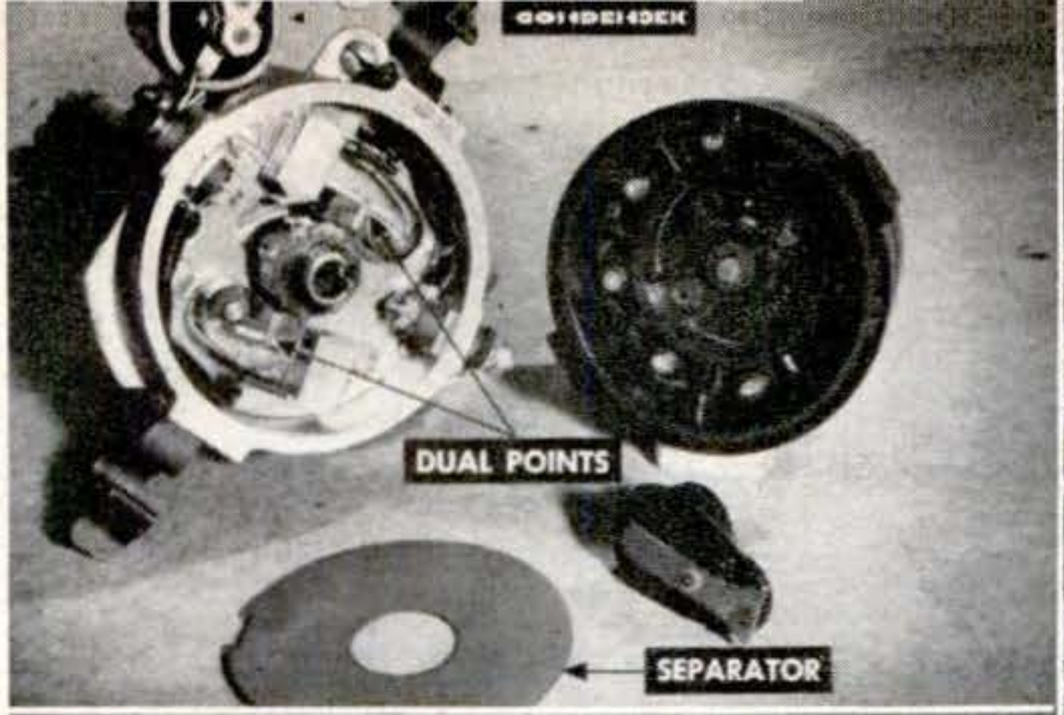

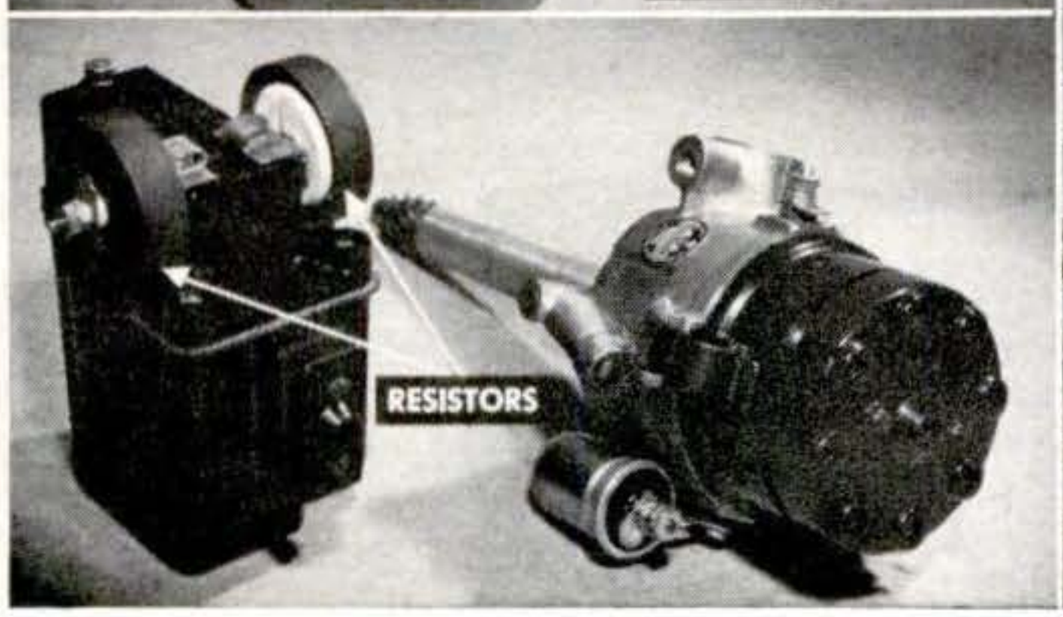

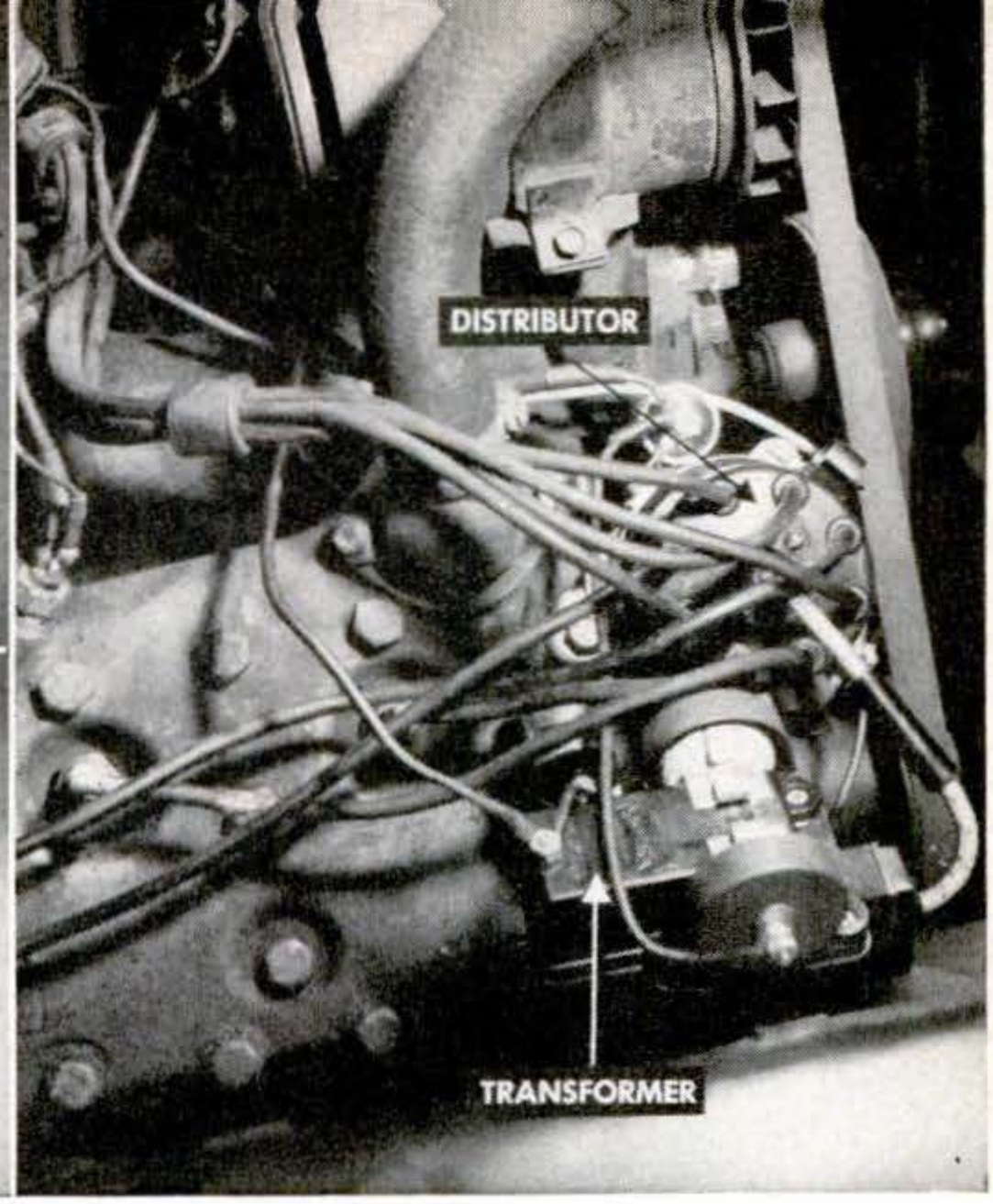

4. New Coil Works Like Magneto. This new magneto-like ignition system gives a long, high-intensity spark at high speeds without the magneto's weakness at low speeds. It consists of a special twin-primary transformer and a dual-point distributor. The first of the two primary windings, instead of collapsing quickly and producing a short spark, is opposed by a current build-up of opposite polarity in the second winding. When the circuit is interrupted, there is a reversal from positive maximum to negative maximum, producing a spark of long duration that improves combustion. The system is said to reduce detonation, eliminate misfiring at high speeds, and permit from five to eight degrees more spark advance. The polarity reversal is also said to prolong plug life by reducing electroplating on the electrodes.

5. Kit Spruces Up Station Wagon. Refinishing kits for restoring the wood parts of station wagons are now on the market. Each kit contains sufficient materials for one average station wagon. Included are paint remover, wood filler, wood preserver, varnish, sandpaper, steel wool, scraper, brush and instructions.

6. Oil Plug. A restricted spark chamber and baffle that recess the electrodes are said to enable this plug to fire in old or worn engines that shoot oil and soon foul conventional plugs. The ground electrode is made of nickel. The shell is finned to dissipate engine heat faster.

7. It's Easier to Change Tires. Leverage applied with this lift makes it easier to handle heavy wheels when you must change tires along the road. Made of steel, it folds into a neat package for storage in the luggage compartment. A larger size handles truck wheels.

Further information on these products can be obtained from: 1. Auto-Cabana and Curtain Co., P.O. Box 222, Syracuse, N.Y.; 2. Braun Mfg. Co., 1657 N. Kostner Ave., Chicago; 3. Eastern Auto, 3319-E S. Grand Ave., Los Angeles; 4. Mallory Electric Corp., 12416 Cloverdale Ave., Detroit; 5. Canell Station Wagons, 616 Communipaw Ave., Jersey City, N.J.; 6. Leonard Spark Plug Co. 148 Summit Street, Newark, N.J.; 7. Clark Distributors, 1044 Fulton St., Fresno, Calif.

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The Model Garageman swaps his fishing rod for a

Gus Peps Up a Tired Truck

By Martin Bunn

GUS WILSON was standing in the door of the Model Garage on a late August afternoon, wondering if he could close a mite early and get in a bit of fishing at the lake, when Glen Showalter drove up in his rattletrap International truck.

Beside Glen sat pretty Enid Bishop, daughter of Sam

screwdriver to pry an obstacle from the path of true love.

Bishop, who ran a sizable grain farm a few miles out of town. Gus had known these youngsters from their beanie-cap days. He smiled up at them now with a broad grin, for he knew that Glen had been courting Enid for some time.

"You're looking prettier than ever, Enid," Gus greeted the girl. "Howdy, Glen. You got trouble?"

"Trouble's no word for it." Glen's face was lined with worry. "I'm supposed to be hauling grain away from Mr. Bishop's combines, and this old tub won't pull the hat off your head. Been fighting it all week—ever since harvest began."

The Kid Doesn't Have a Nickel

Gus was on the point of asking Glen why he hadn't brought the truck in before, but he checked the words. Everybody in town knew the kid didn't have a nickel to his name. Glen had been reared by a widowed father, far up in the hills, on little more than a milk cow, a small garden, a pair of ragged overalls and a dirty shirt. The town had thought that the son would be like the father—honest enough, but content to neither sow nor reap.

Enid Bishop had changed that. Now, Glen was making a desperate gamble to get into business. He had bought the old International for a few dollars down, worked half the summer to get it into shape to haul grain by harvest time. Kind-hearted farmers had seen fit to give the kid a break. If the truck held together through harvest, Glen could earn enough to pay it off, trade it in on a better one, and gradually work his way into a year-round trucking business.

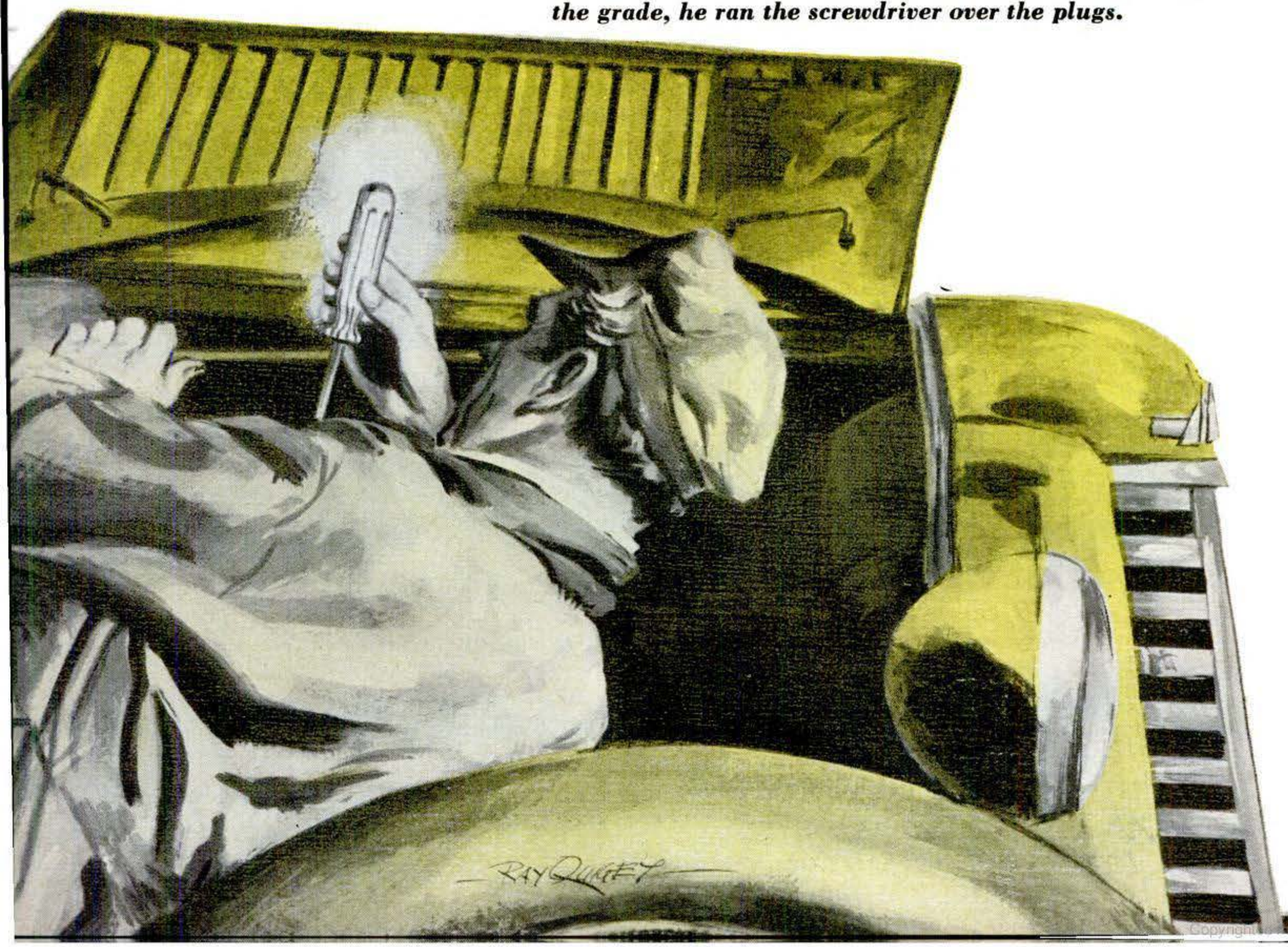
Dreams Are Riding on Battered Truck

If the truck didn't hold together? Gus looked into the eyes of Enid Bishop and had the answer. Two kids in love would find their dreams shattered. He cocked his ear to the motor, which was idling nicely.

"Sounds all right to me, Glen," he said.

"That's the tough part of it," Glen exploded. "I ground the valves, took up the bearings, installed new rings, and tuned her the best I knew how. She's all right on the idle, but misses to beat Harry when you

Gus rode out on the fender. When they revved up for the grade, he ran the screwdriver over the plugs.



rev her up. No good on the pull. And she's got to pull tomorrow, or I don't have a job."

"Don't worry about it," Gus reassured him. "We'll make her hit, or know the reason why."

"I won't be able to pay you until—" Glen began.

"Forget it," Gus cut him short. "Your credit is good here."

He was rewarded by the look Enid gave him as he lifted the hood. All this rig needs is a set of decent plugs, Gus told himself, as he removed a weird assortment of old ones, put them in the sandblasting machine, and tested them under compression. To his surprise, none of them was in bad shape.

While the plugs were out, Gus got his compression gauge and had Stan Hicks, his helper, turn the motor over while he ran a test on each cylinder. He found that Numbers 3 and 4 were about 10 pounds weaker than the rest. That wasn't unusual—especially on an old truck that had just had new rings installed. Some of them probably weren't fully seated yet. Even so, all the cylinders had enough compression so they shouldn't miss.

Gus made a routine check on coil, condenser, wiring and points. Everything seemed okay. Mentally bidding his fishing trip goodbye, he climbed up under the wheel.

Gus Suggests a Ride

"Let's take a ride," he said. "We'll head her onto the steep hill just out of town. If she's going to miss, she'll do it there, even if she isn't under load."

"She'll miss, all right," Glen said grimly, as he got in beside Enid.

The old International backed out of the garage and moved down the street, purring like a kitten.

They rolled across the flat, and Gus picked up speed for the hill ahead. As the motor revved up it roughened and developed a distinct miss. Two cylinders, he told himself, as sure as you're born. He shifted, hit the top of the grade, slowed down and put her in neutral.

"You drive, Glen," he said. "I'll ride the fender a bit."

Gus lifted the hood, a neon-tube screwdriver in his hand. When they revved up for the next grade, he ran the screwdriver along the tops of the plugs. Every one of them flashed its gaudy red fire through the transparent handle. Yet cylinders 3 and 4 were missing. Pull or no pull, he knew, now, this wasn't ignition trouble.

Gus got back inside the truck. "Let's take her back to the shop," he said.

As they dropped onto level road, he turned to Glen again. "Now, throttle her down. As slow as she'll take it."

The truck idled perfectly. Gus reached his foot across to put gentle pressure on the brake pedal. Not until the speedometer was wavering at the 10-mile mark did the old motor begin to buck. No engine could perk along like that with bad valves, and compression had tested out well enough.

"When you did your overhauling job," he asked Glen, "did you clean out the valve guides, and test the valve springs for strength?"

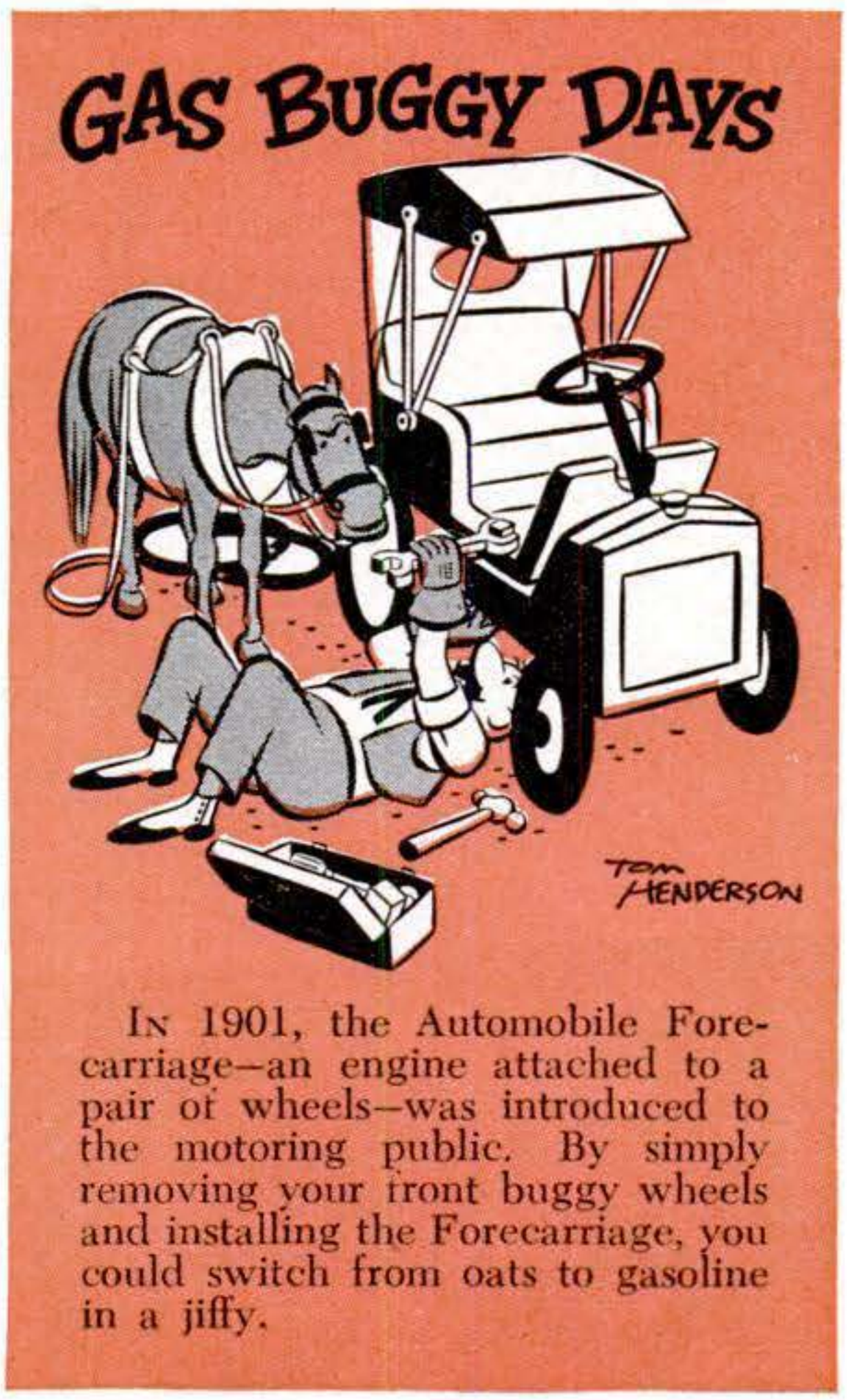
"Cleaned the valve guides with a wire brush," Glen nodded. "I didn't have the springs tested, but they seemed all right."

"Let's see," Gus puzzled out loud. "You've had this trouble ever since you took the motor down?"

"It didn't miss at first, Mr. Wilson," Enid put in. "Remember, Glen, right after you got it done we drove up on—" She cut herself off and blushed.

Yeah, Gus thought. They went up on Lovers' Hill, where they could look out over the lake.

[*Continued on page 218*]



In 1901, the Automobile Forecarriage—an engine attached to a pair of wheels—was introduced to the motoring public. By simply removing your front buggy wheels and installing the Forecarriage, you could switch from oats to gasoline in a jiffy.

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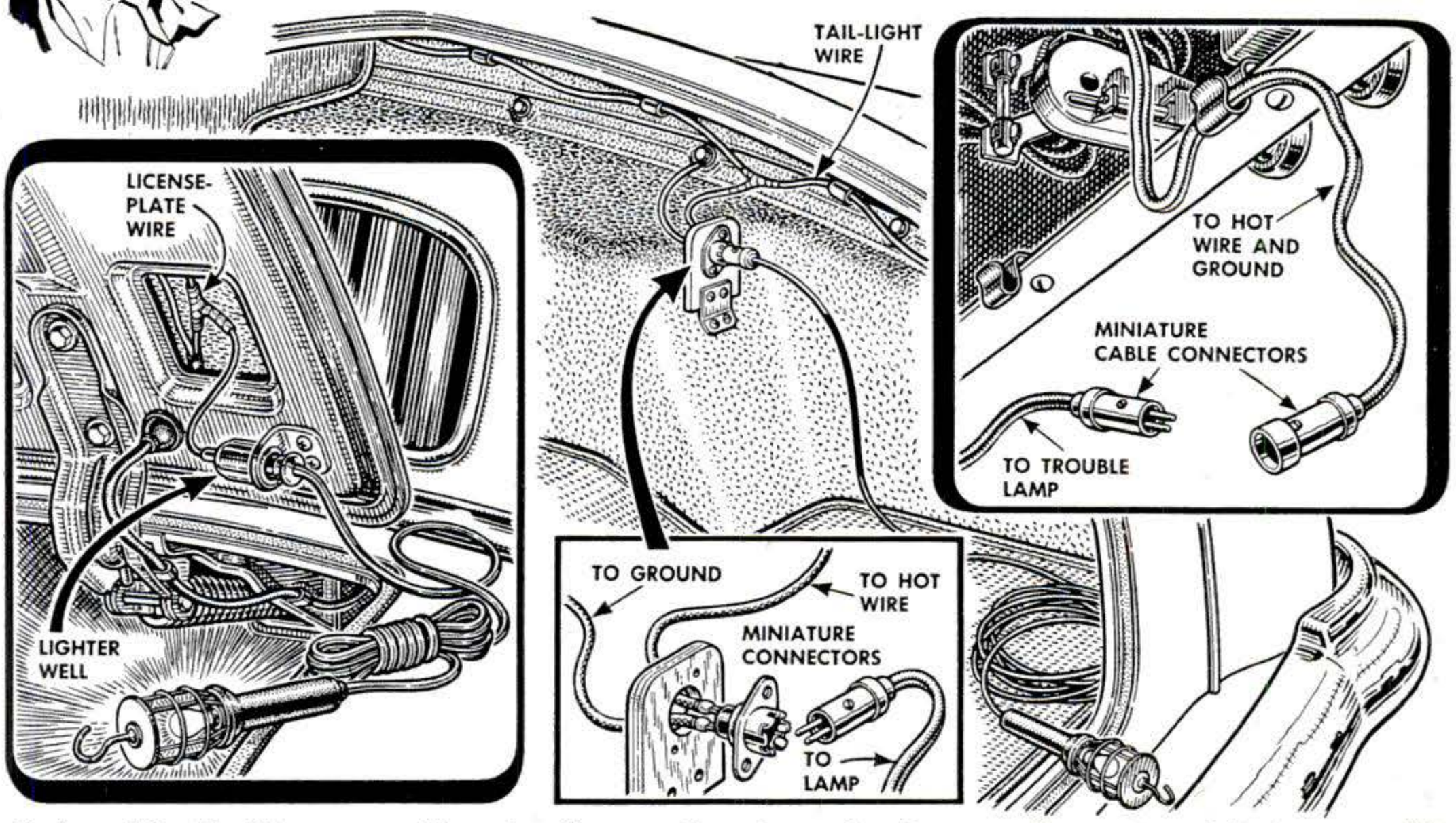
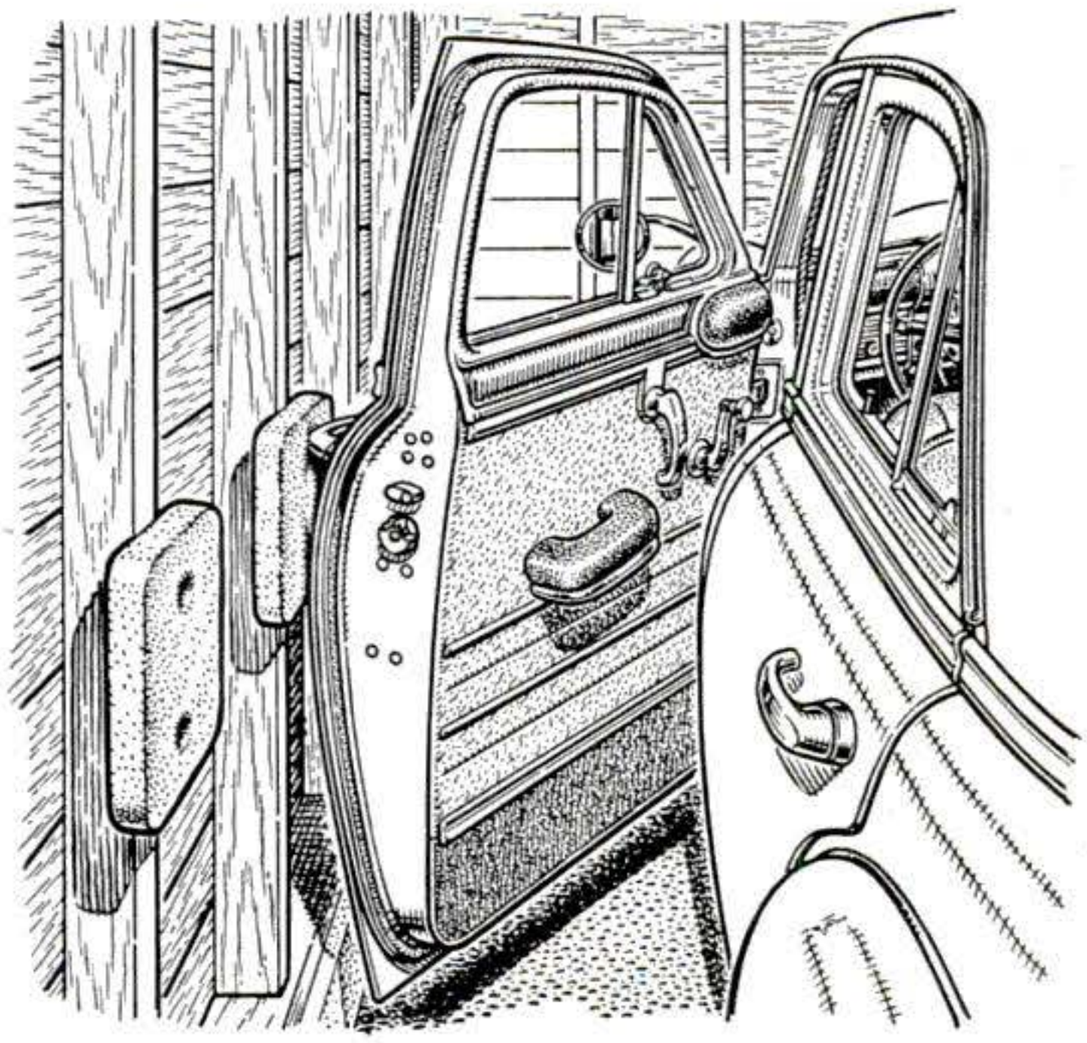
Hints FROM THE MODEL GARAGE



A trouble-light connection in the trunk is a handy addition to a car. If you have a light that plugs into the cigarette lighter, an additional lighter well, attached to a bracket under the trunk lid, will extend the range of its usefulness. You can connect it to the license-plate wire. Miniature cable connectors available from radio-parts stores also offer a convenient means of hooking up a light. Two of these sketches suggest how to use them in connections in the trunk and behind the dash.

Leaving the doors half-latched when a car is in the garage is a good custom. This will give rubber weather stripping a chance to regain its resiliency.



Wall bumpers made by nailing rubber kneeling pads to the wall will keep car doors from being scarred when they are opened in a garage where space is tight.

Please turn the page for more auto hints.

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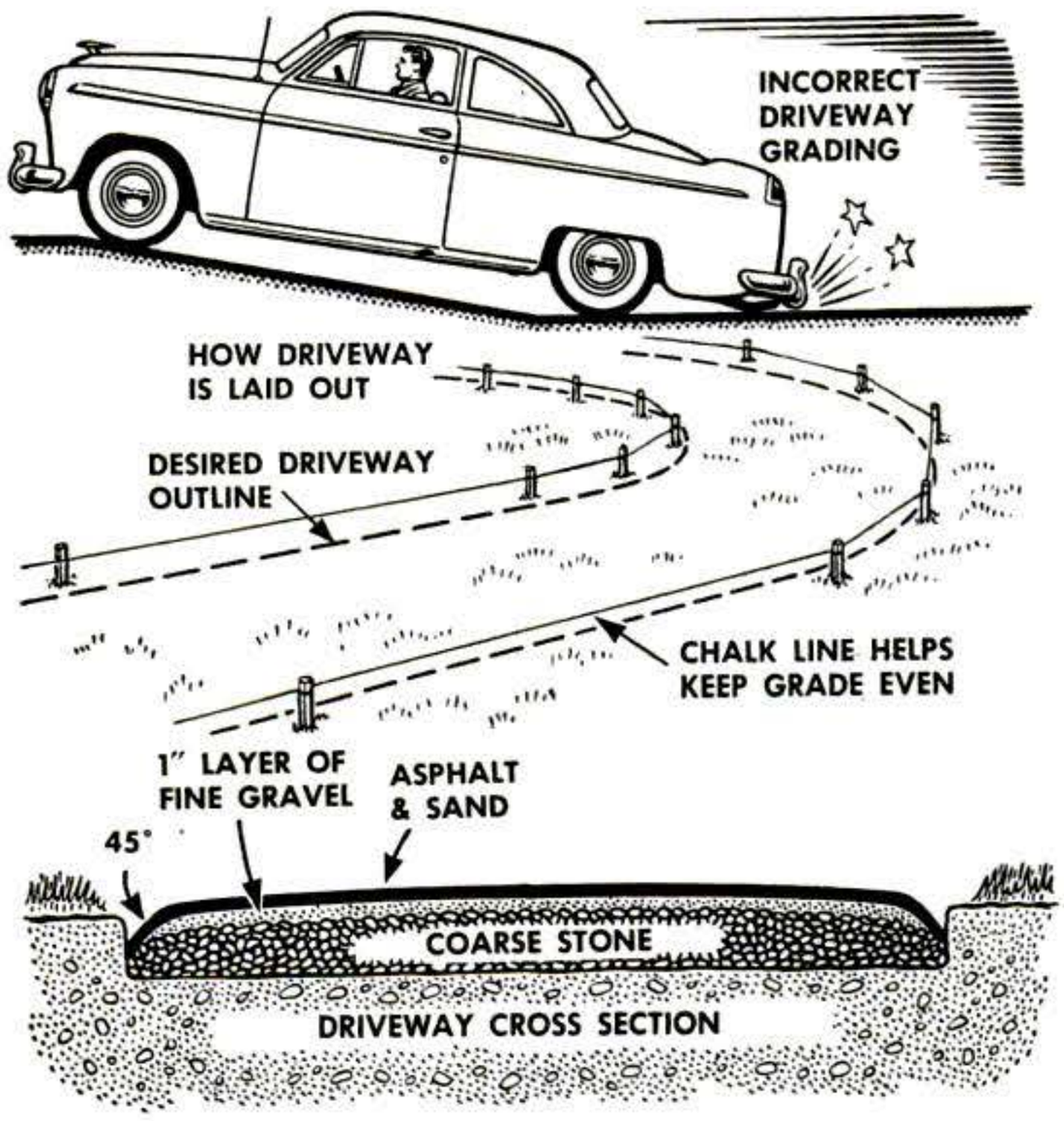
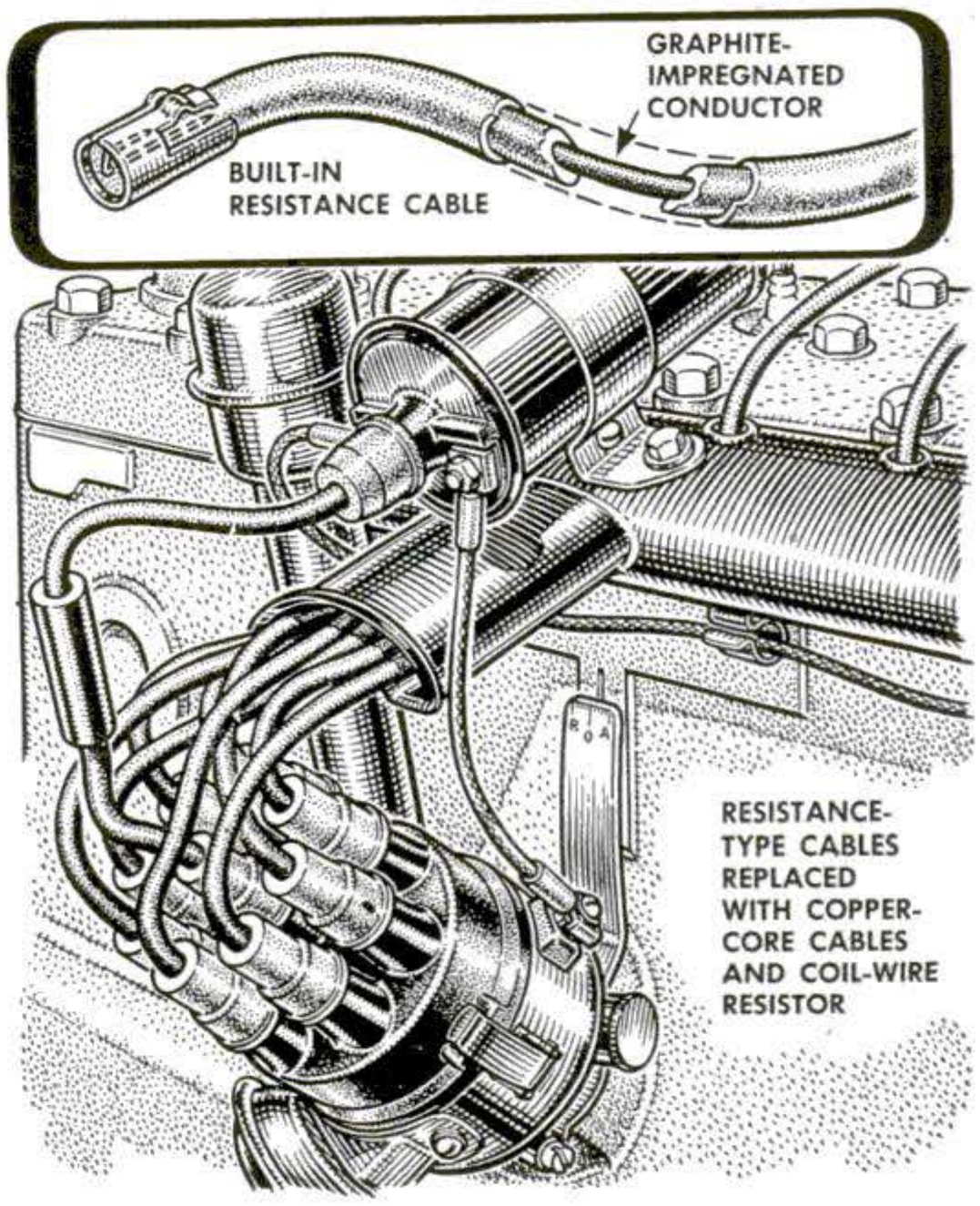
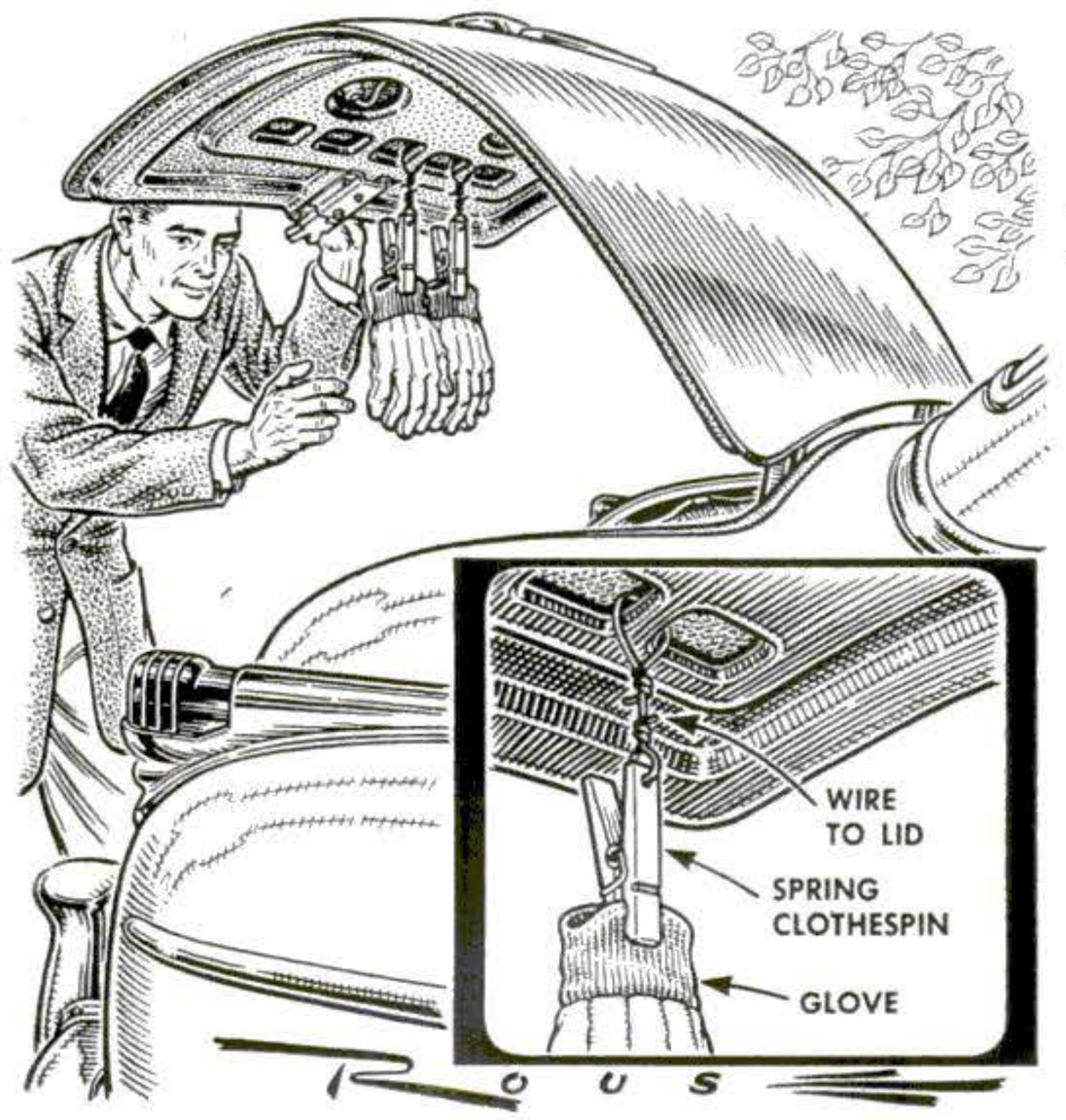
MORE Hints from the Model Garage



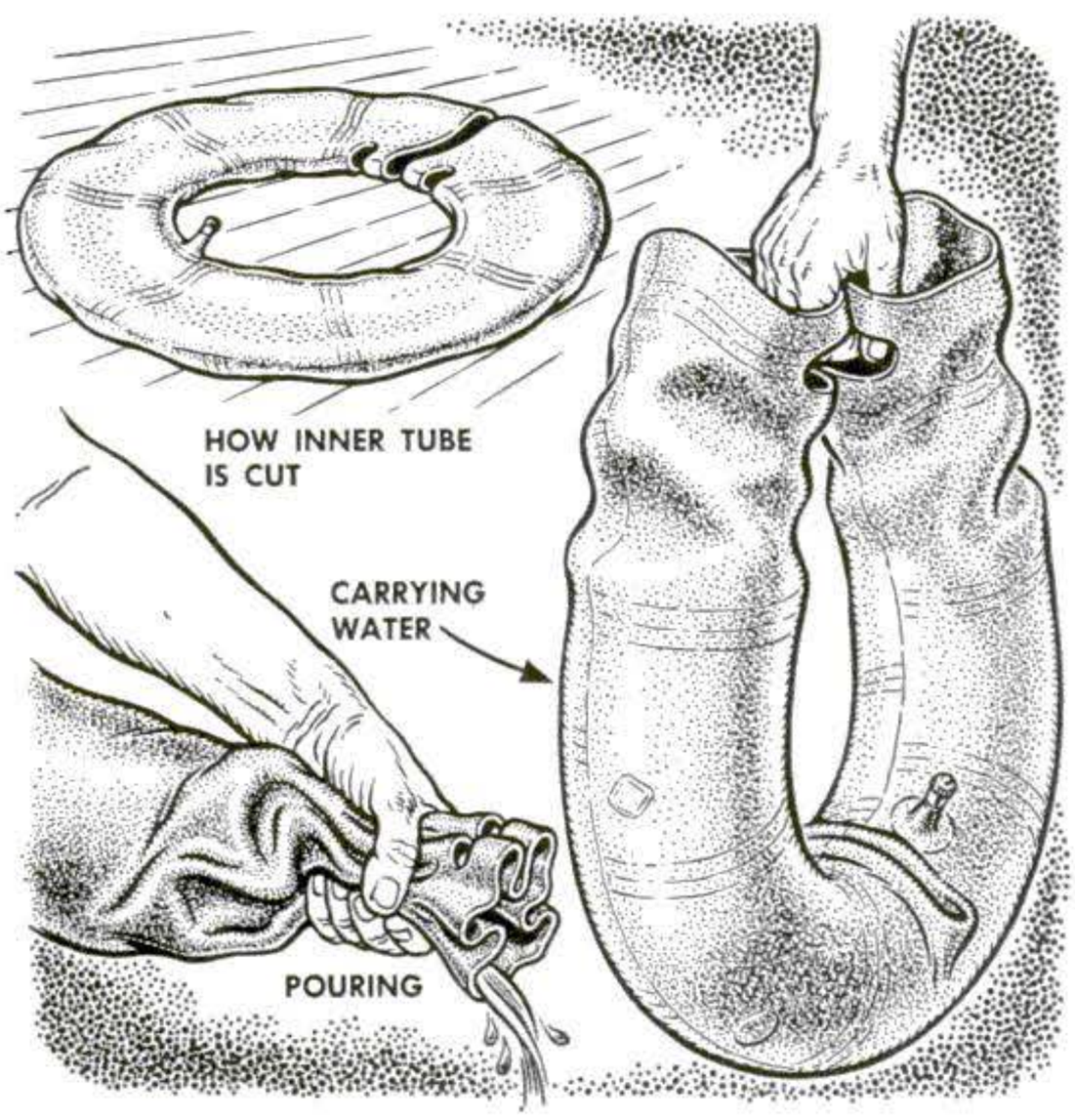
A sharp grade change, perhaps where a driveway joins the street, will cause bumpers and tailpipes to scrape the pavement. So if you are planning a new approach to a garage located above or below street level, lay it out to avoid abrupt grade variations. The sketch shows other helpful points for building a driveway.



When a tune-up fails to restore an engine's pep, have the ignition cables checked if they are the resistance type. New ones may be needed. Otherwise, you might try the trick of one reader who installed regular stranded cables, put a carbon-type suppressor in the coil wire and found the engine showed marked improvement.



Work gloves for changing tires or other roadside jobs will always be easy to find if you suspend them in spring-clip clothespins wired to the trunk lid.



An inner tube cut like this and stowed away in the luggage compartment takes up little space—and will be ready for use if you need a container to carry water.

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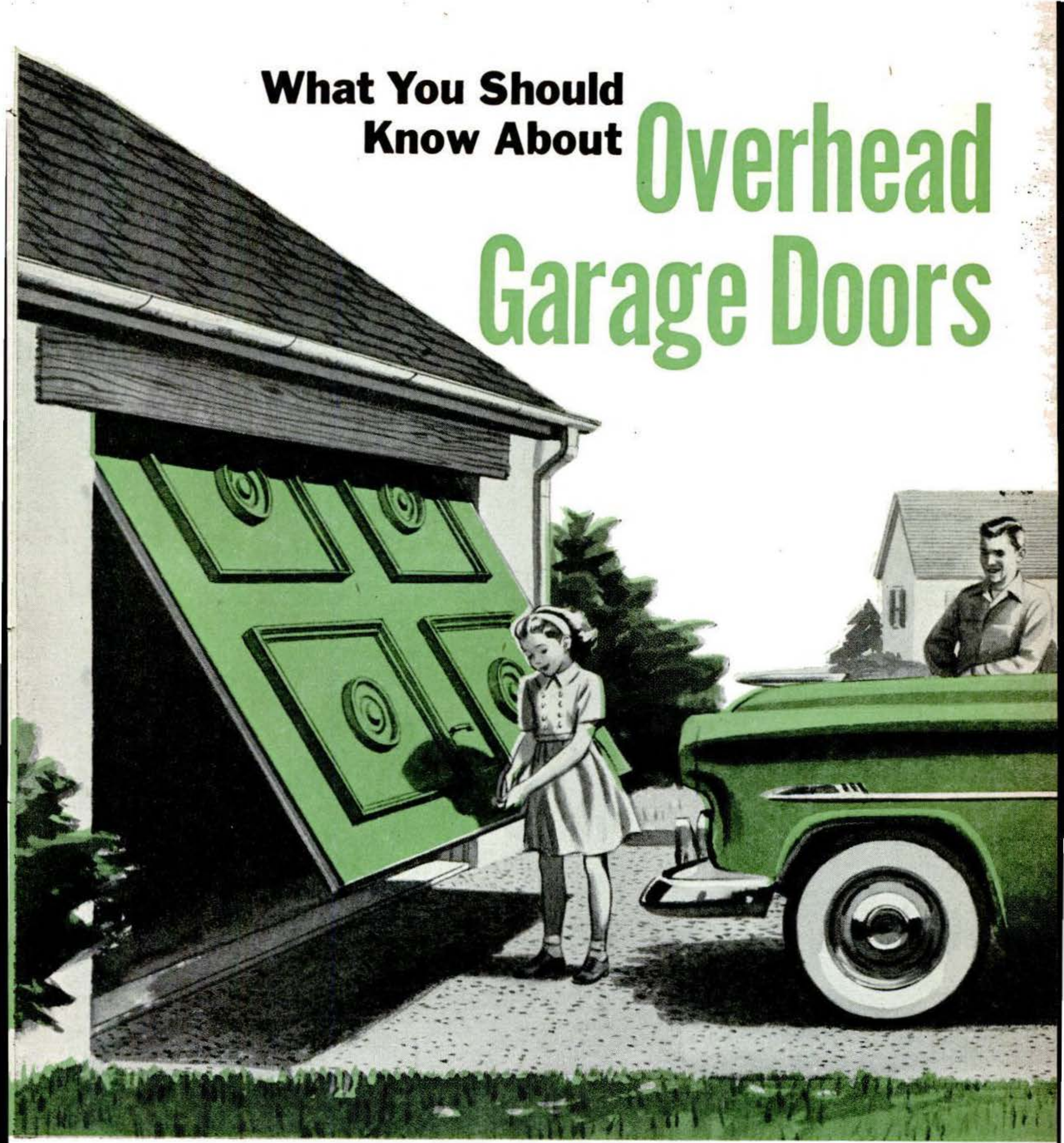
What You Should Know About Overhead Garage Doors



If you would like the type that swings or rolls up, here's how to build and install your own at less cost.

GARAGE doors can be made to behave. Gone are the days of struggle with the sliding type, or banging your fenders on swinging doors that stubbornly refuse either to stay open or remain closed.

By putting in about a day's work, you can equip your garage with a convenient modern door that swings up overhead out of the way almost at the touch of a finger. Here are ways to keep down the cost of such a door:

- Buy hardware and lumber and build a

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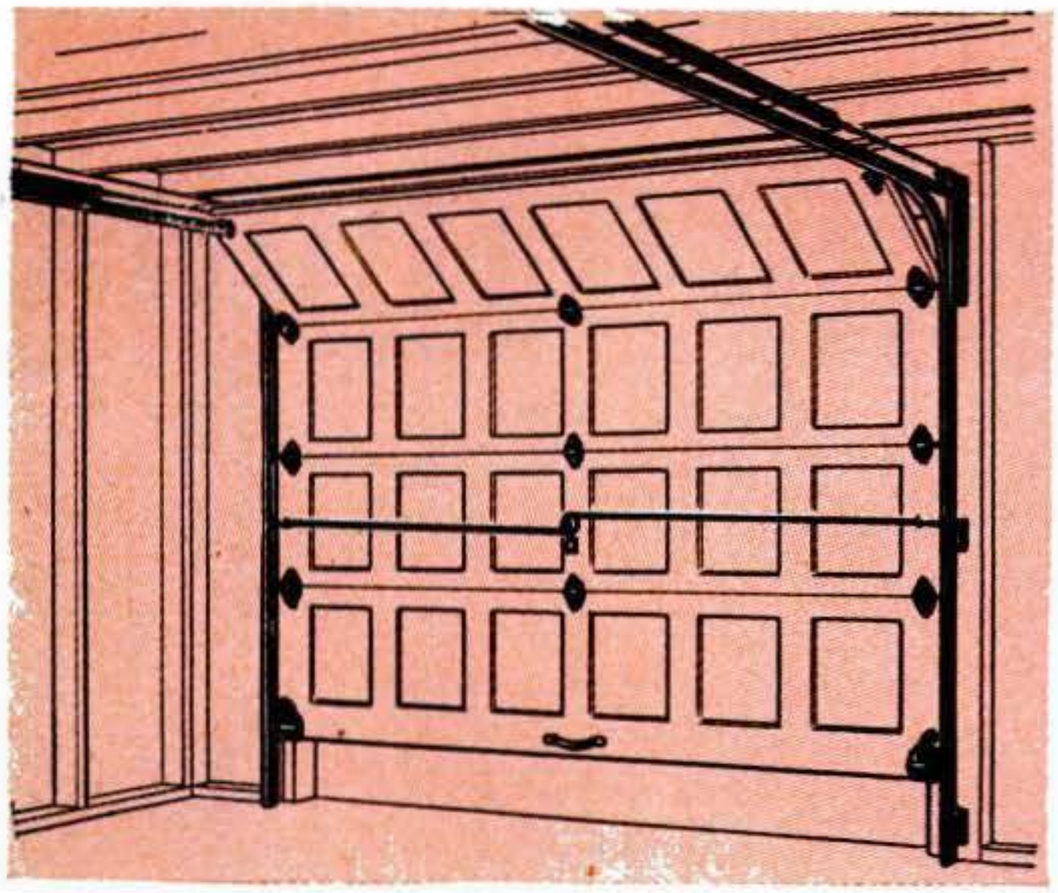
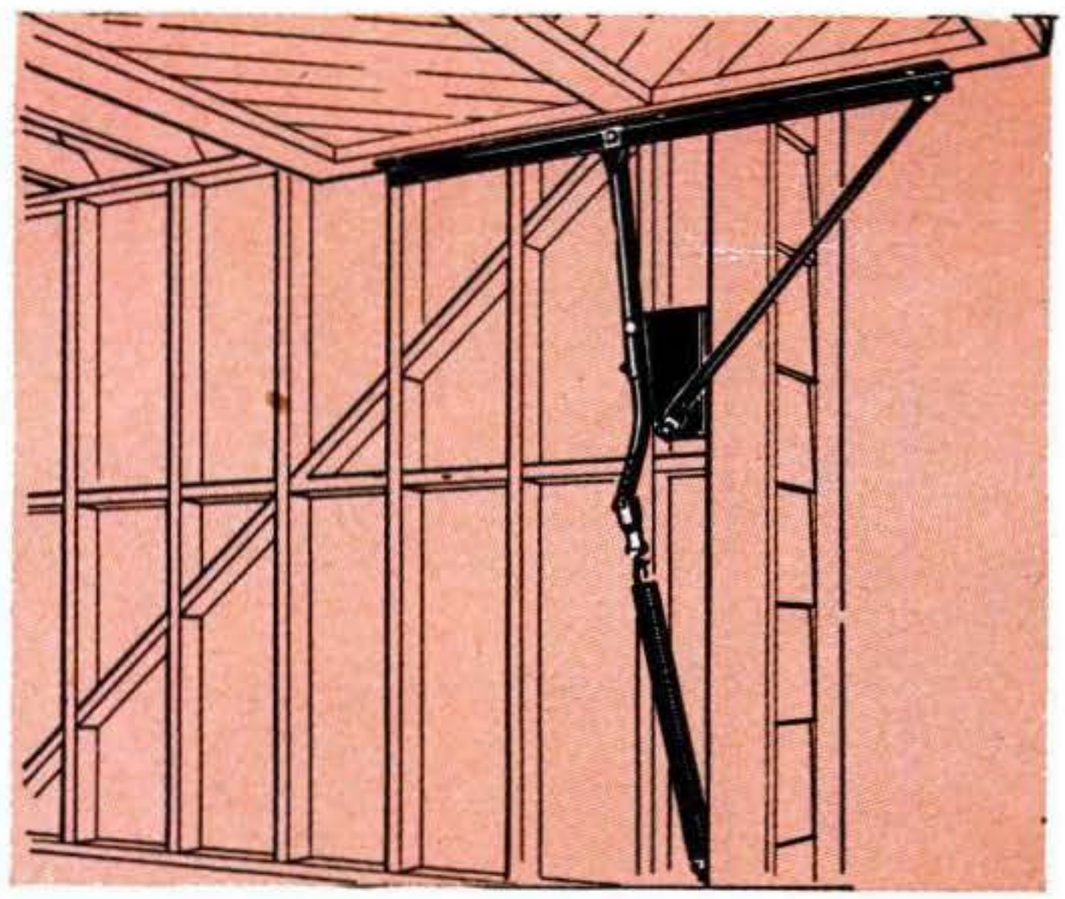
Overhead Doors Work on These Types of Hardware

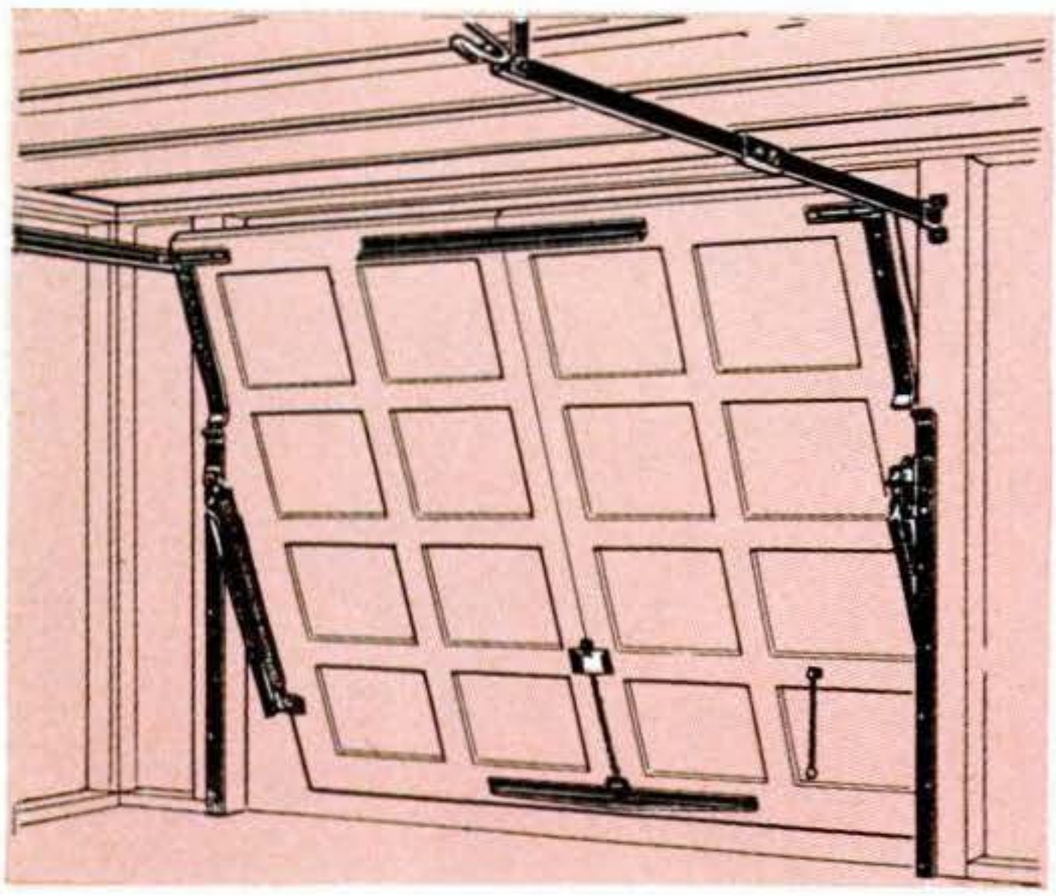
Overhead garage doors operate on three general types of hardware—jamb, pivot and track. Jamb and pivot types are usually least expensive. In most cases, strong springs do the work when you operate an overhead door but one track type has a counterweight.



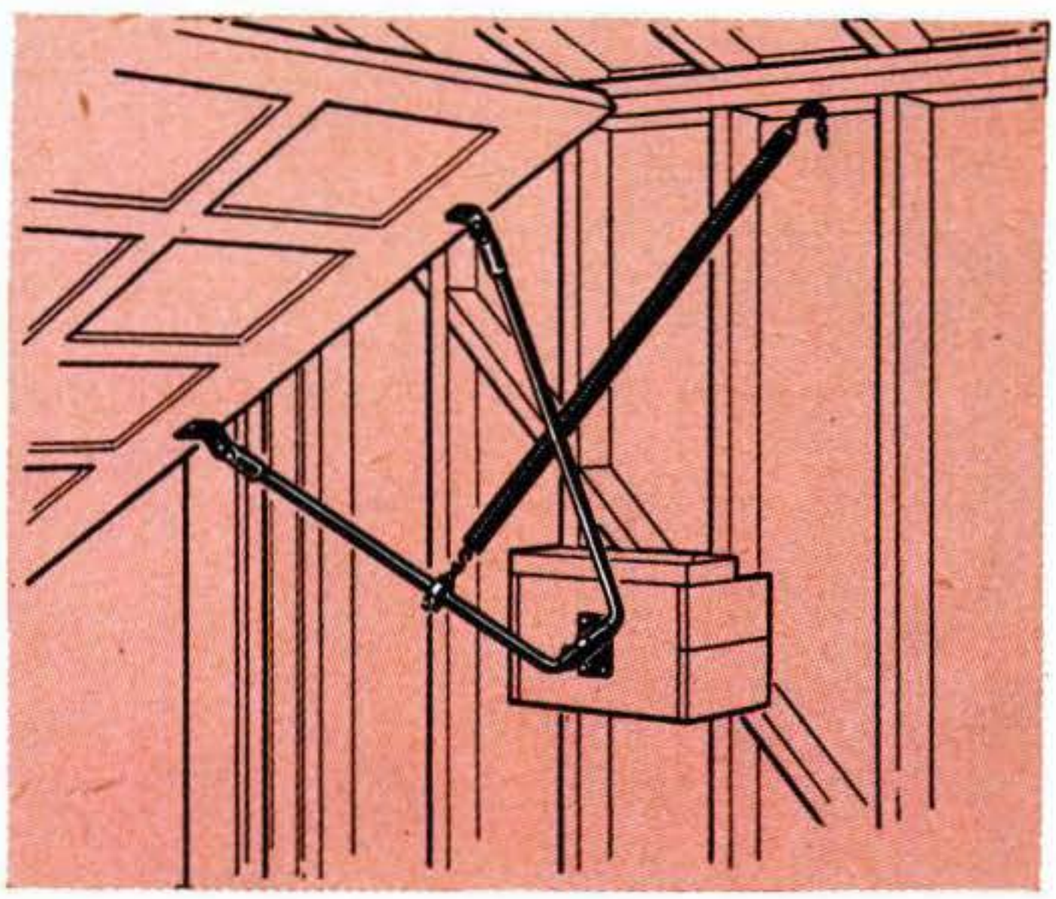
Track for Roll-Up Door



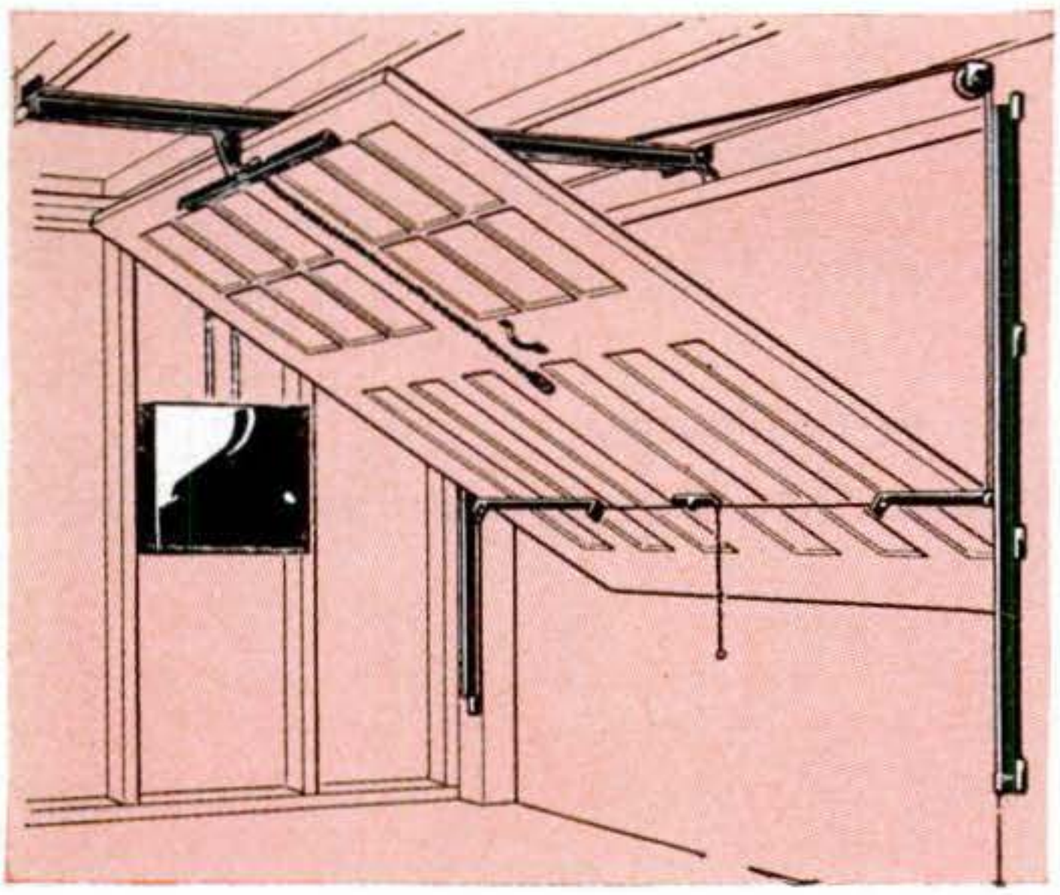
Jamb Type



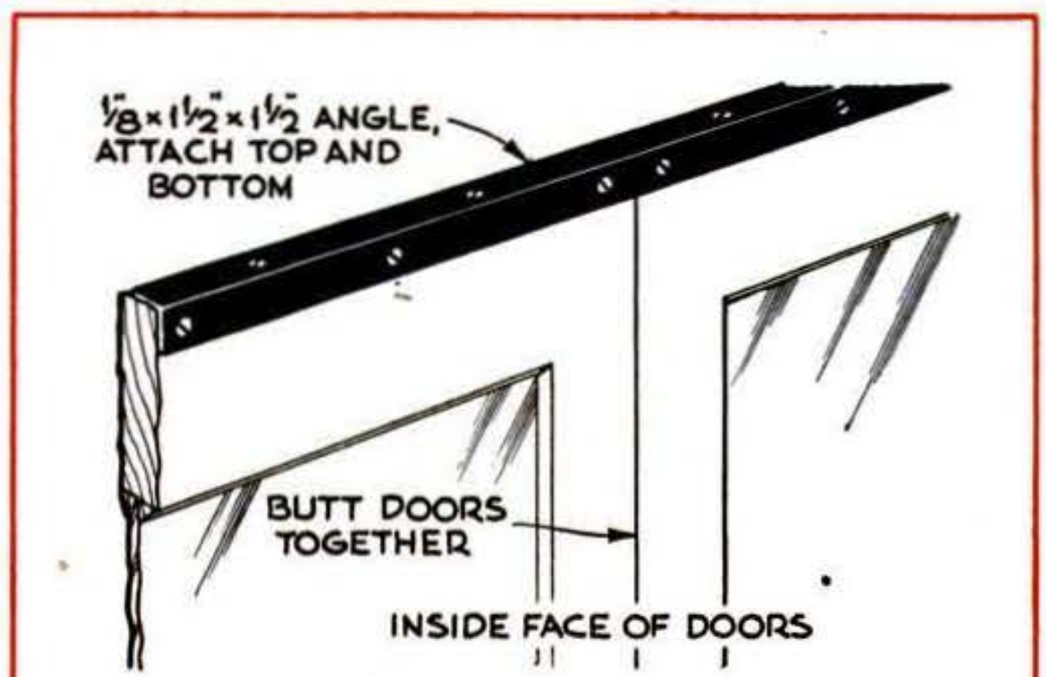
Track for Swing Door



Offset Pivot



Track with Counterbalance



Swinging doors can be converted to the overhead type by screwing angle iron to the top and bottom edges to make them a single rigid unit.

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new door, using one of several practical designs.

- Buy the hardware and convert an existing pair of swinging doors to a single overhead door.
- Buy an overhead-door kit, assemble the door and install it with hardware that comes with the kit.

Any of these three procedures should save you money over ordering a ready-made door, either of wood or metal, and paying a carpenter to put it up. Converting swinging doors to overhead operation would, of course, be least expensive—the hardware would be your only cost.

Types of hardware. Three basic types of hardware are used to mount overhead doors and swing them up and down—jamb, pivot and track.

Jamb hardware is attached to the inside edges of the two upright wood members (the jambs) that form the sides of the garage door opening. It works by leverage.

Pivot hardware is bolted to the side walls of the garage and works the door by swinging it up and down. This type is not easily installed when the garage itself is much wider than the opening.

Jamb and pivot hardware is suitable only for one-piece, rigid doors that tilt or swing up and down. With the track type you can have either a rigid swing-up door or the sectional roll-up kind. Roller-bearing wheels moving on steel tracks make such doors easiest to operate. Unlike doors mounted with jamb or pivot hardware, these can be weather-stripped. Hence, track doors are most popular in cold regions. However, they cost more.

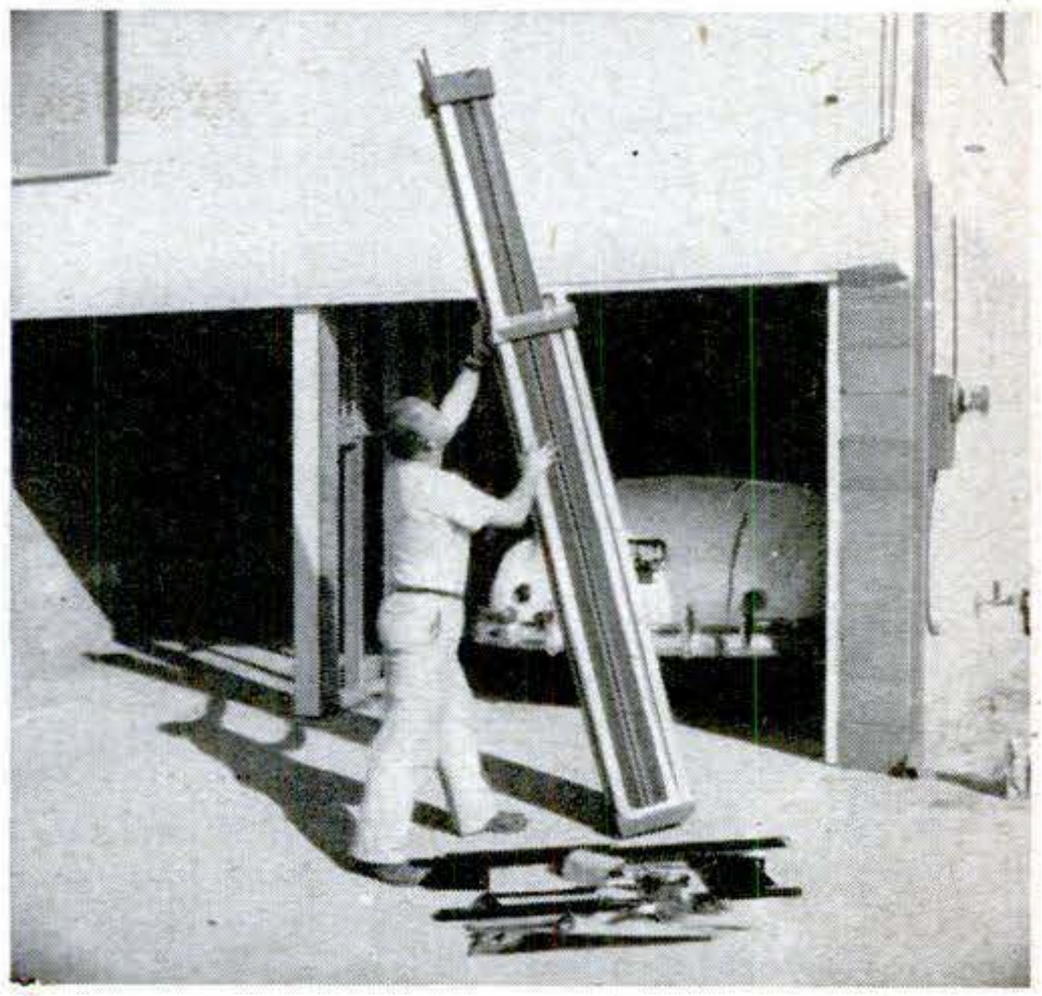
Hardware should be selected to suit the weight of the door. Most sets are safe only if the door weighs less than 150 pounds. If your door exceeds that figure, you should buy heavy-duty hardware.

Preparing the opening. If your garage is nearly new, the opening probably will be ready to take the new door. If you replace a hinged or sliding door with one using jamb or pivot hardware, the opening probably will have to be reworked.

Above all else, the opening must be squared up. Otherwise the door won't fit. If you are installing a ready-made door, it may be necessary to reduce the size of the opening. Two-by-sixes nailed to jambs and header usually will take care of this.

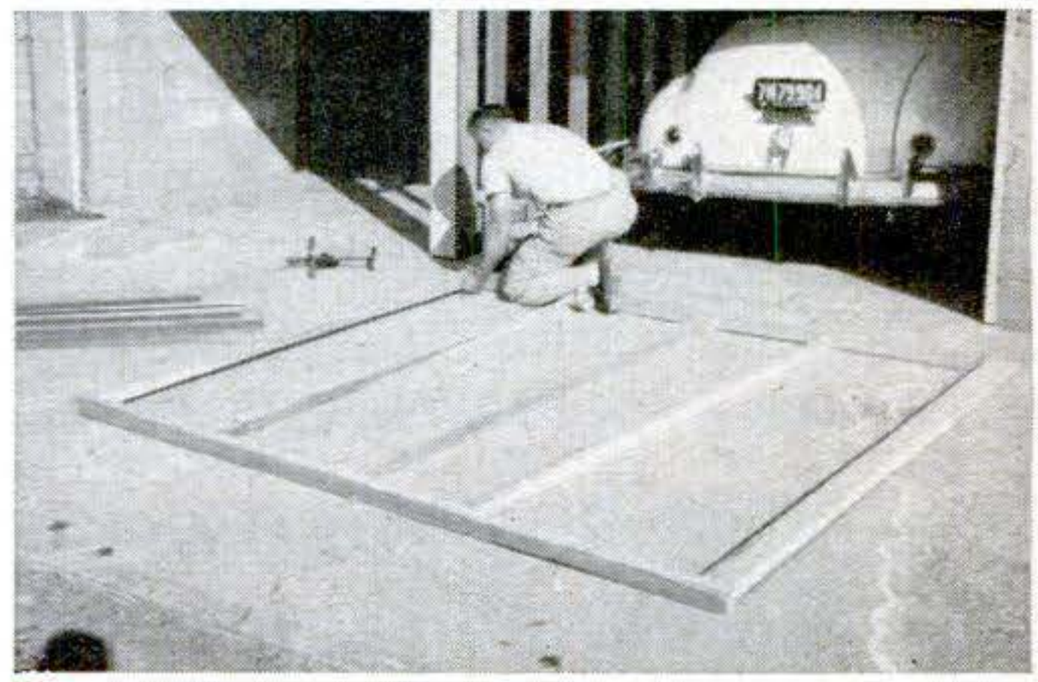
What style door? Besides being light in weight, perfectly square and well nailed,

Kit of Materials Makes It Easy to Put Up a Door



1 HERE'S WHAT YOU GET when you order single-door kit from Cossart Enterprises, Los Angeles. Jamb-type hardware comes in one package, wood to build door in another.

2 AS FIRST STEP, the top two-by-three framing member is marked for length, ¾" clearance being deducted from jamb-to-jamb distance. Bottom member is marked same way.



3 OTHER FRAMING MEMBERS are two-by-fours at ends, laid flat; a two-by-three in middle and a pair of two-by-twos. The material is for a door 7′ wide and 8′ high.

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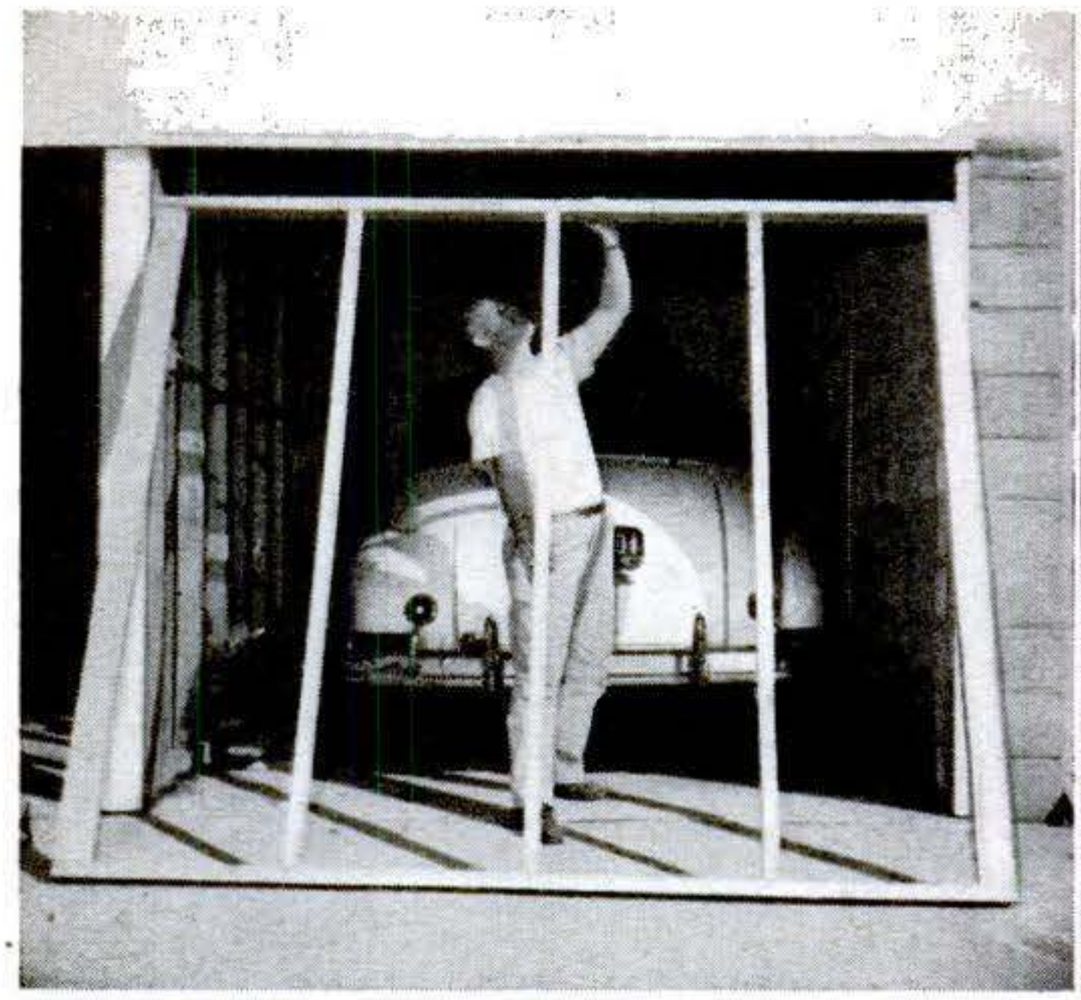
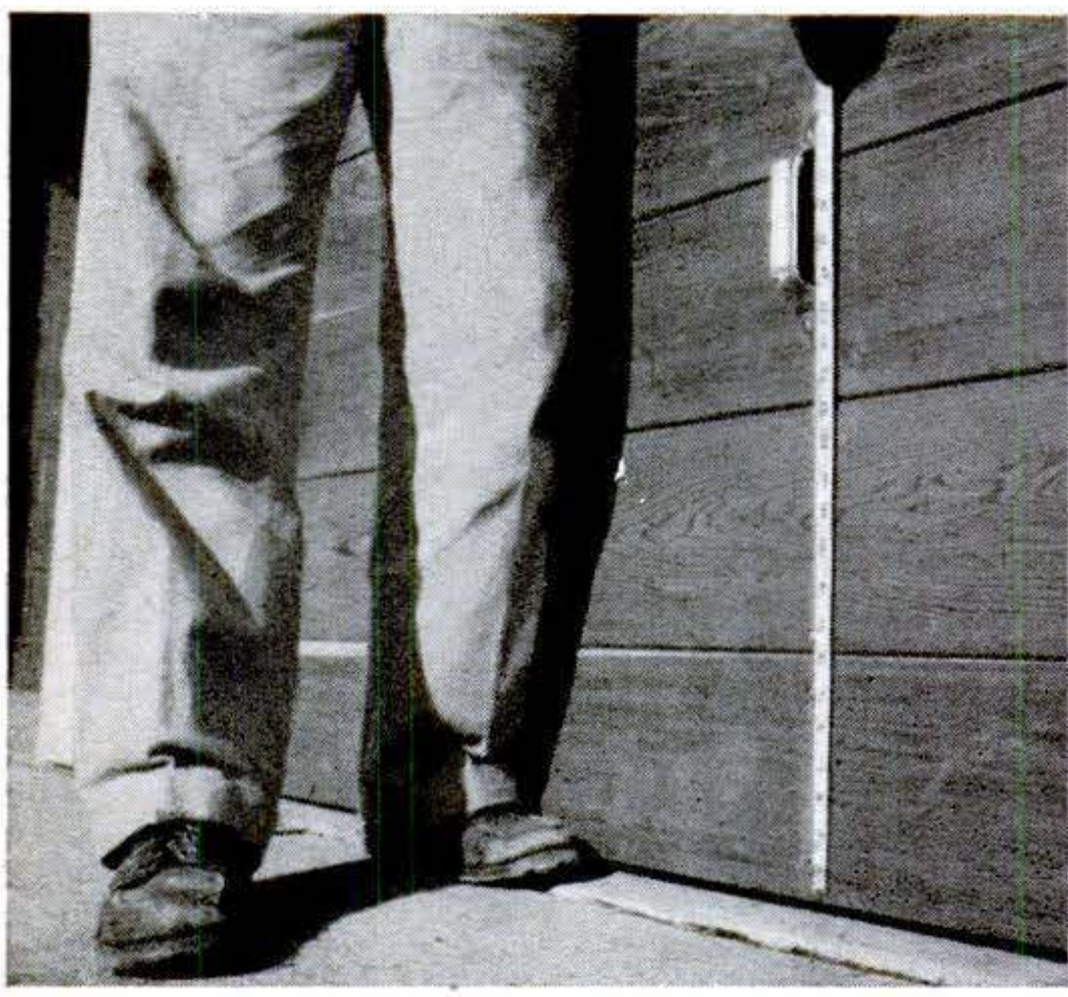
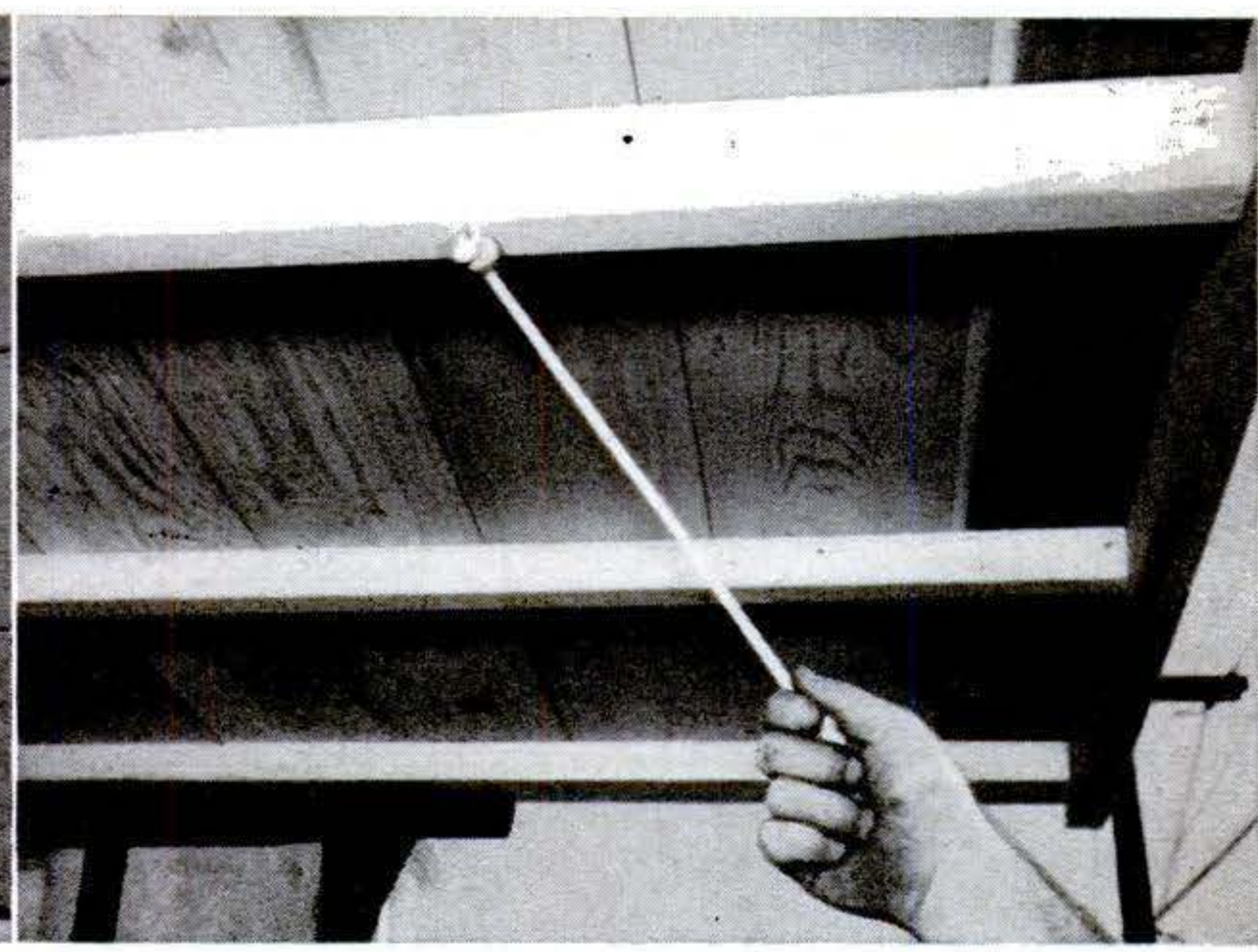


4 FRAME IS TRIED FOR SIZE after being nailed together. Drive nails through top and bottom two-by-threes into ends of vertical pieces. Face flush side of frame outward.

5 TEMPORARY BRACE is tacked on (put it inside rather than outside as seen here) after frame has been squared by ¾" wedge between header and top edge and jamb end.



8 HANDLE GOES IN MIDDLE of door 16½" from the floor. This is best position for good leverage, and the handle will not hit the header when the door is swung up.



9 A PULL ROPE furnished with the kit is then knotted to an eyebolt and screwed into the middle two-by-three frame member so everyone can reach the door to pull it down.

the garage door you buy or build should be in keeping with the architecture of your home.

A plain board door will serve a strictly utilitarian function when facing an alley. Windows and shutters admit light and relieve the broad expanse of a double door facing the street. But however you decorate a door, be sure the design fits both your home and pocketbook.

Door maintenance. After your door is up and functioning smoothly, keep it that way by a regular program of maintenance. A door can do quite a bit of damage if it should fall down on your car—or your head.

Keep all nuts tight and lubricate bearings at least once every four months. Inspect the clamps on pivot hardware and tighten them if necessary. The clamps sometimes slip up on the power arms—as you can see by the marks made on the power arm. Before tightening, pound the clamp down on the power arm to its original spot.

A truss cable usually keeps double garage doors straight while in the up position. If your door sags, the truss tapes need tightening. Before doing this, prop up the door with a two-by-four.

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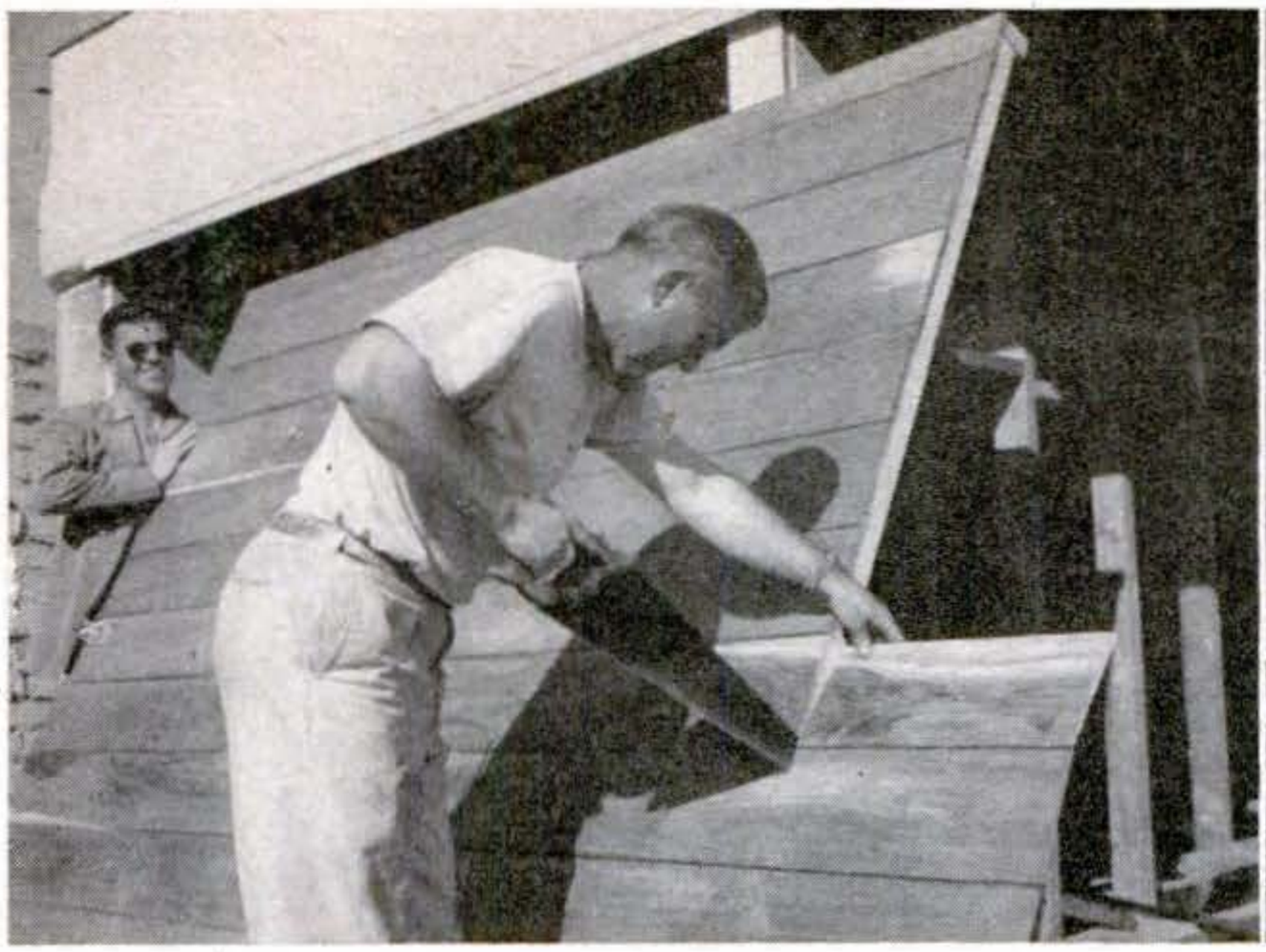
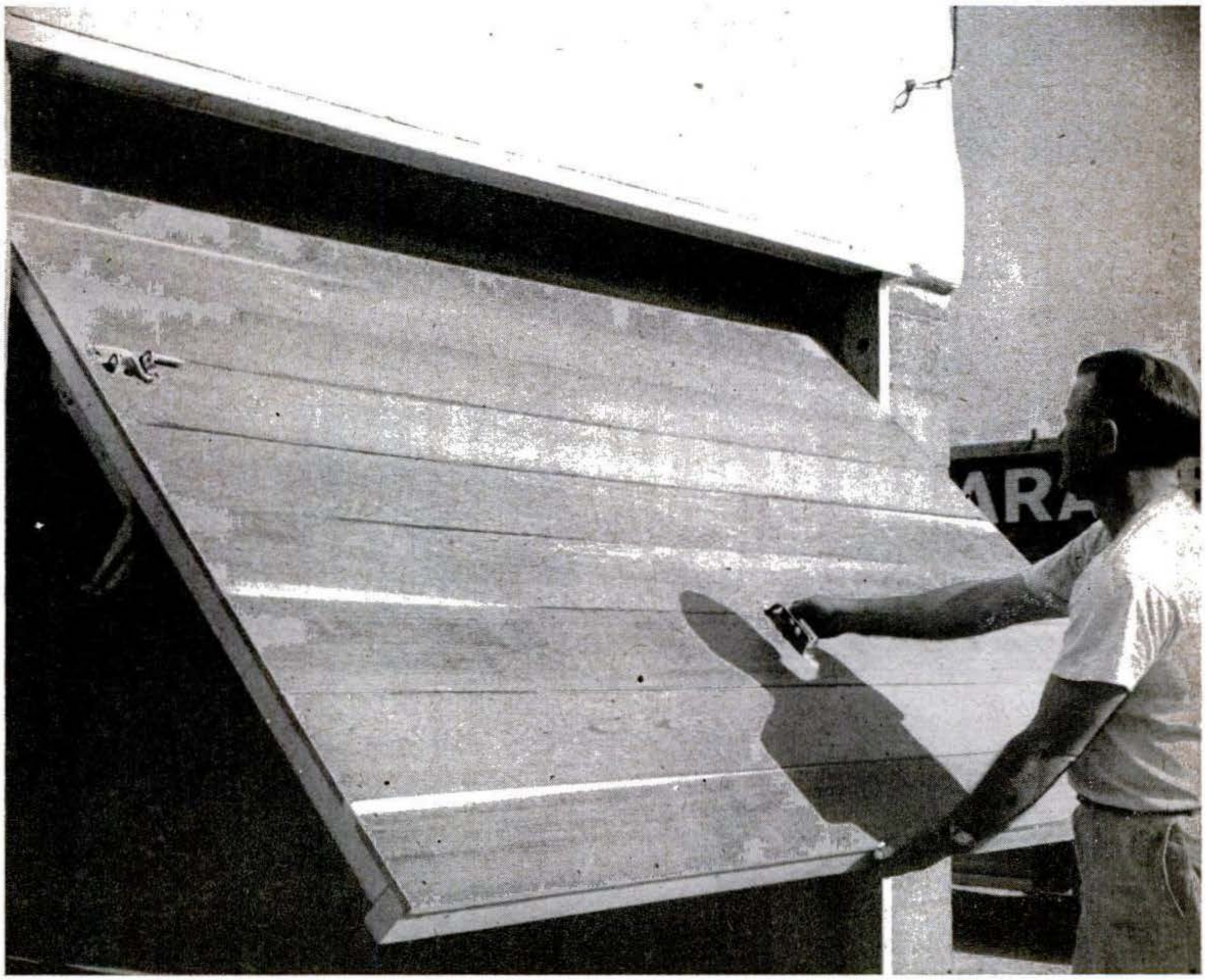


6 EXCESS LENGTH of redwood sheathing is cut off after all the pieces have been nailed on the frame. Each piece of sheathing must be drawn up snug against preceding one.

7 HARDWARE IS INSTALLED according to instructions that come with kit. Base of unit goes against inside of jamb. Door is shimmed into opening with 3/8" stock until mounted.



10 FINISHED DOOR can be raised or lowered with just fingertip pressure if it is properly installed. The price of this kit is approximately $44 FOB, Los Angeles.

Please turn the page for more garage-door pictures.

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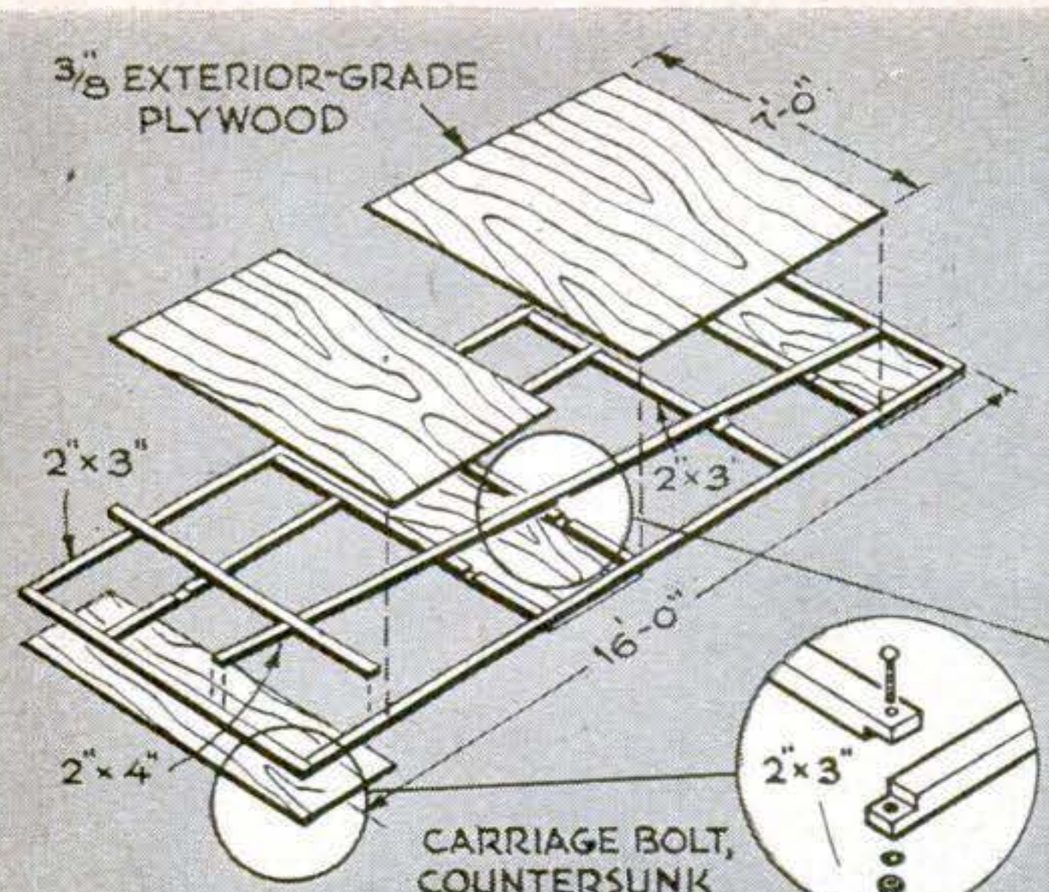
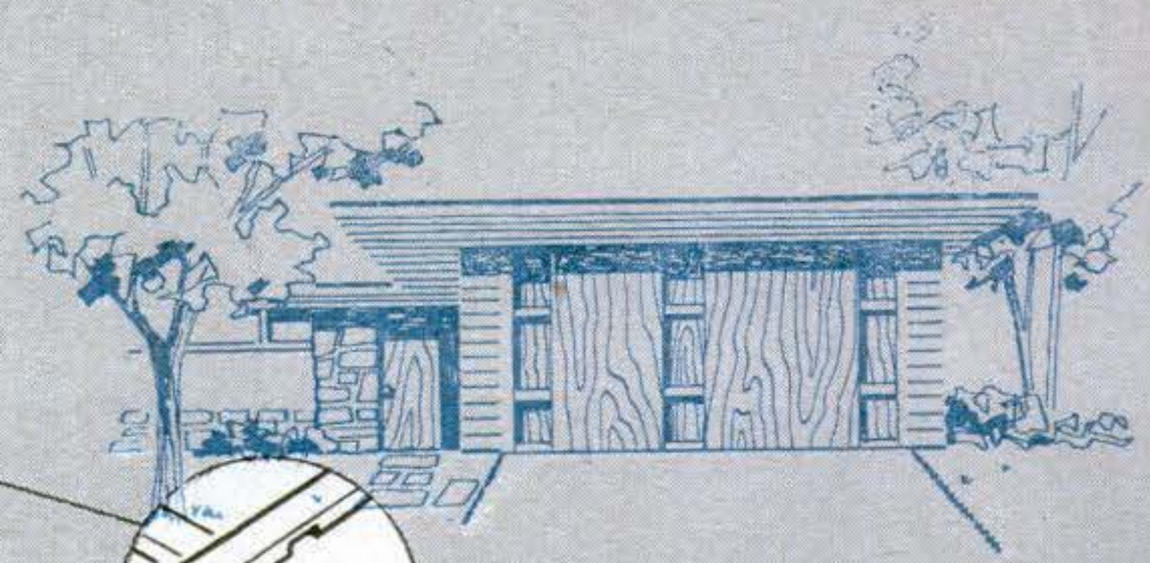
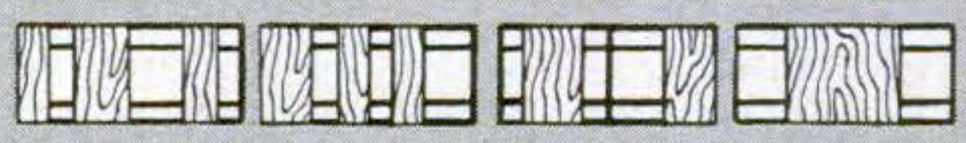


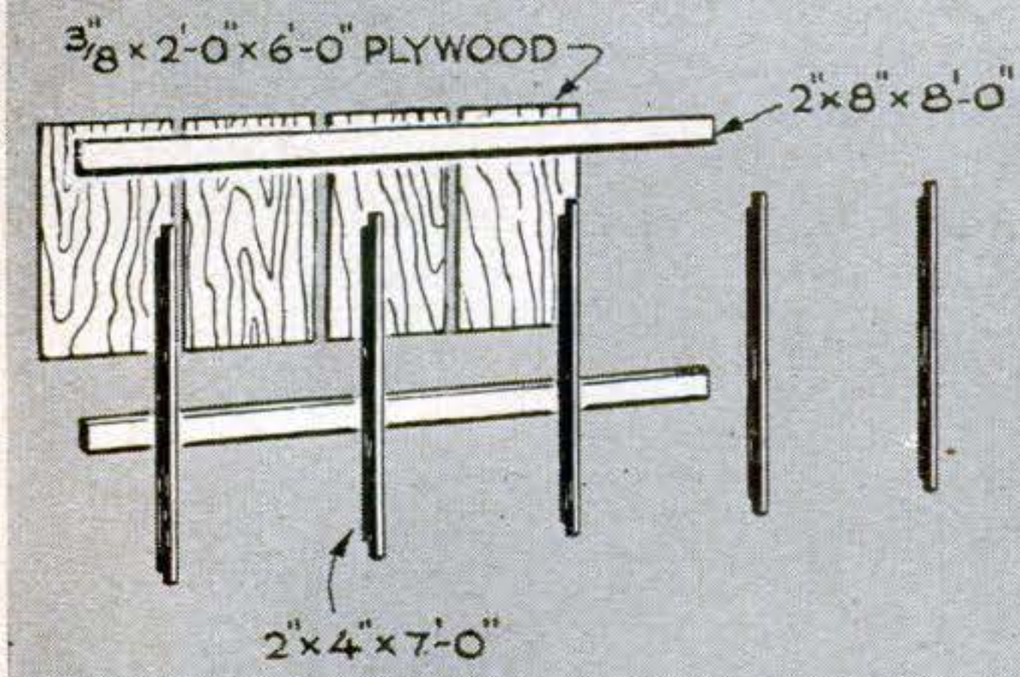


Broken surface of this door, a contest prize winner, creates interesting lights and shadows. By varying the surface panels, you can match the forms of the house so the door will be a well-integrated unit. Vary the levels of the two horizontal pieces to match nearest window sill and transom. Set and putty the nails or screws used to hold facing to frame.

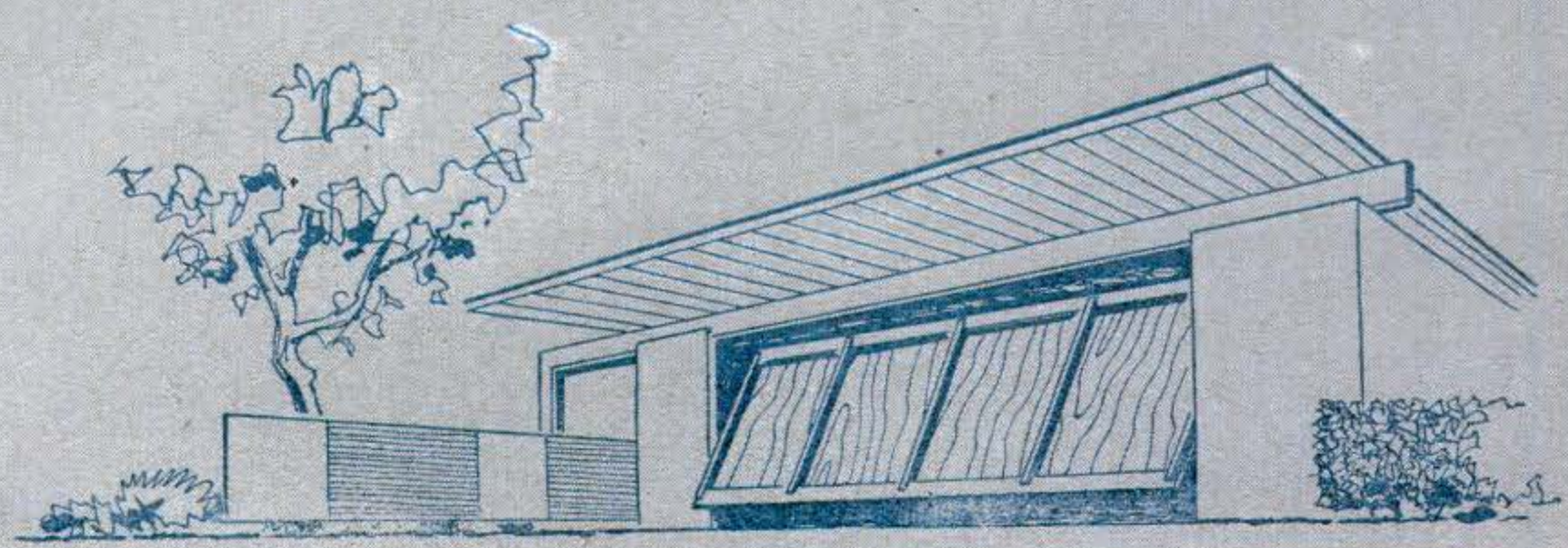


Prize-Winning Doors

HERE are garage doors in a style to suit modern homes. Architects designed them as entries in a contest for doors the average homeowner could build. Co-sponsors of contest were the Tavart



Framing creates the design here. One or more of the plywood panels can be replaced with translucent material. Plywood can be left natural or painted, depending on effect desired by the homeowner.



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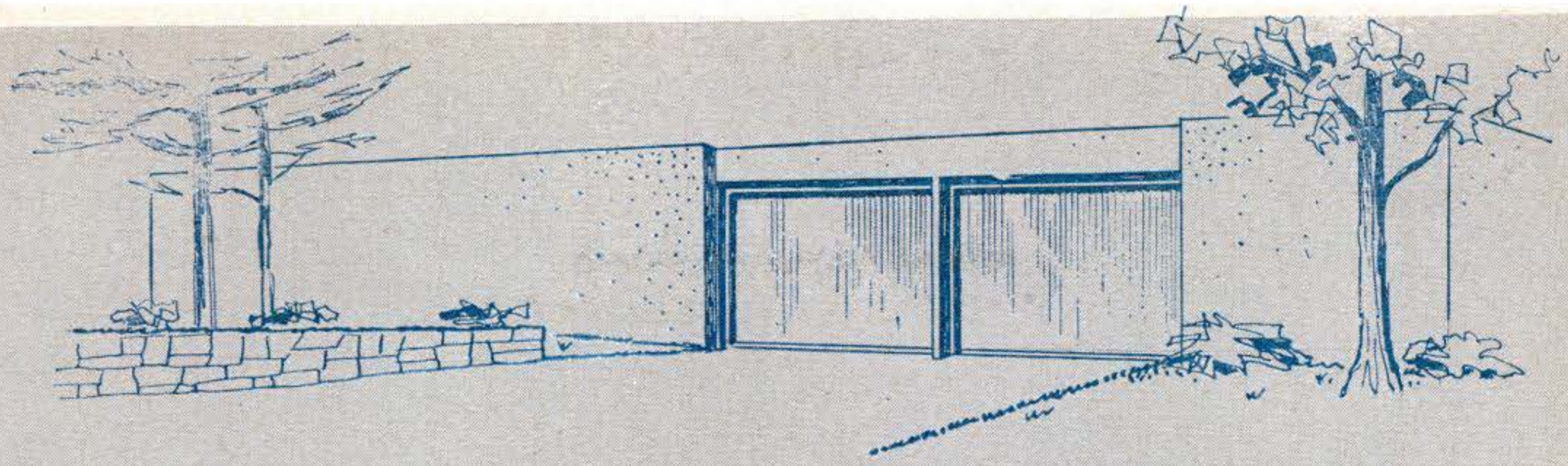
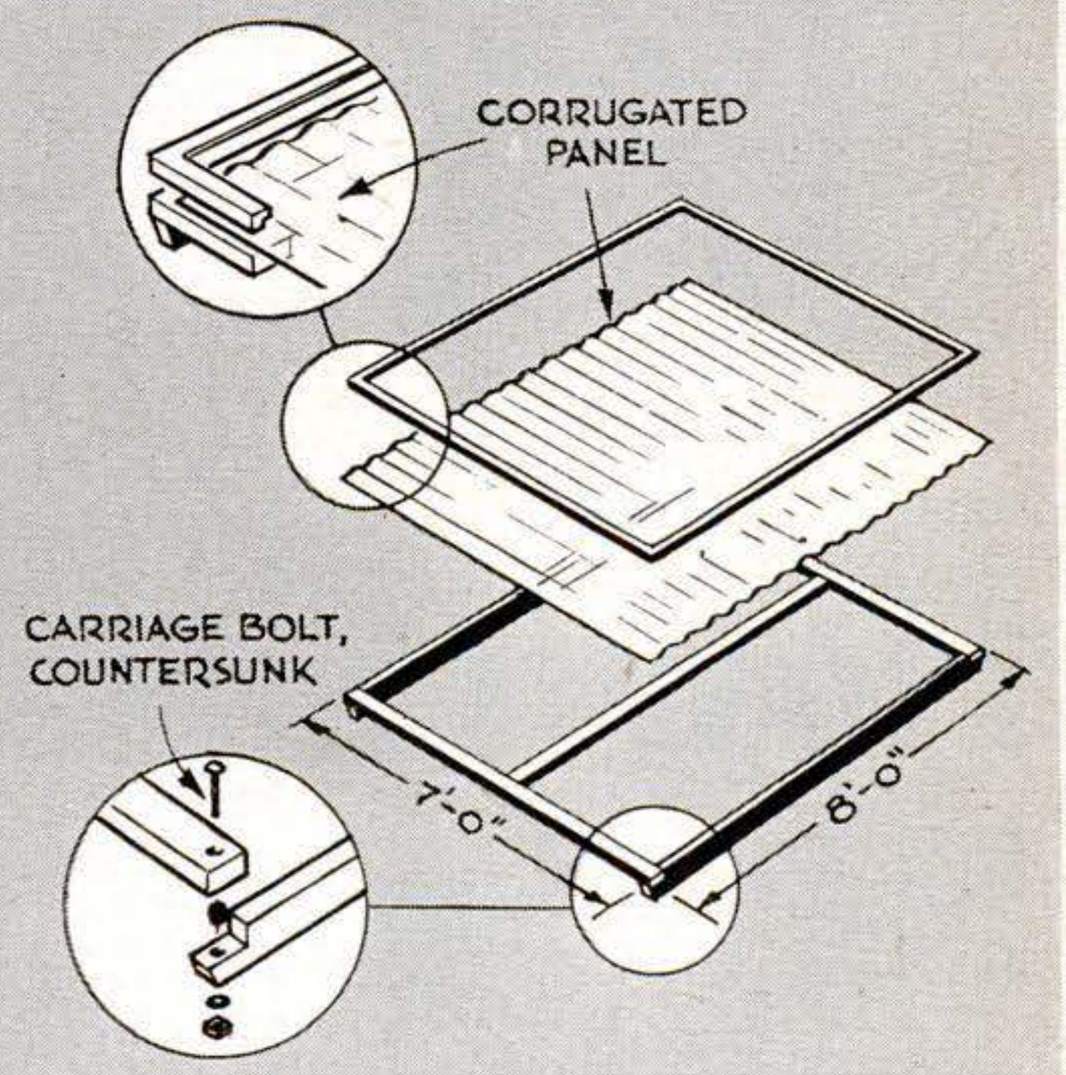
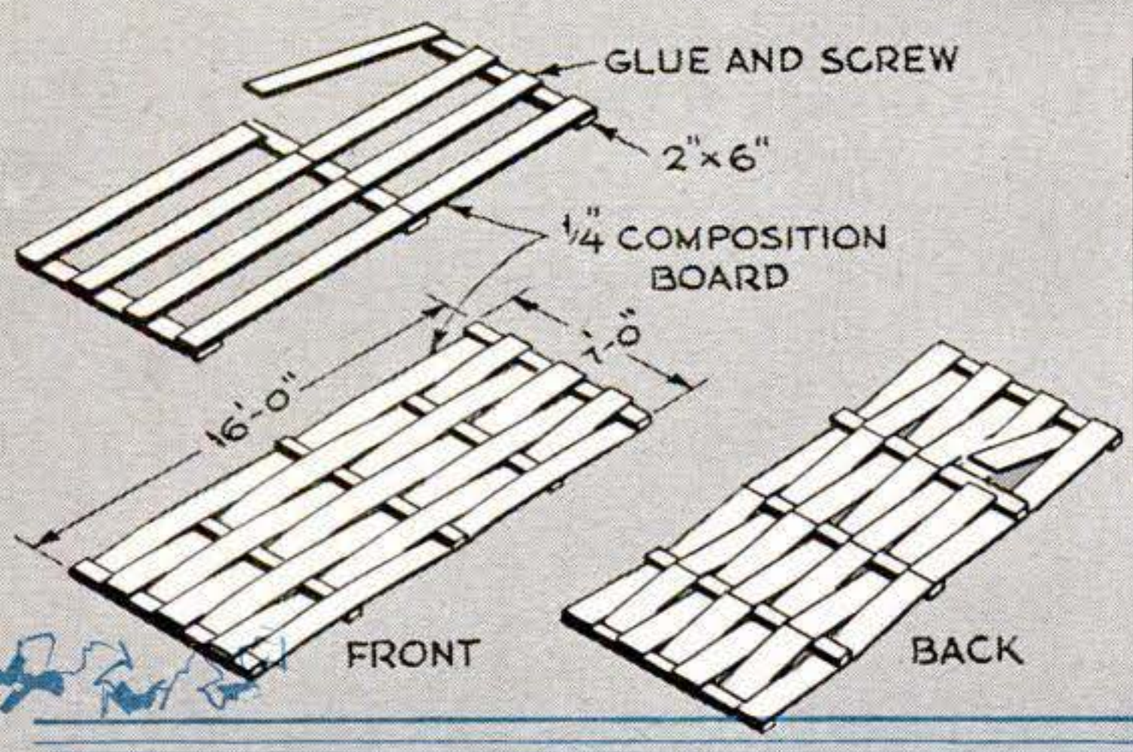


Translucent corrugated panels of reinforcing Fiberglas and plastic are used as the closure material for this handsome door. Assemble the rear frame from two-by-fours, use two-by-twos to hold panels.

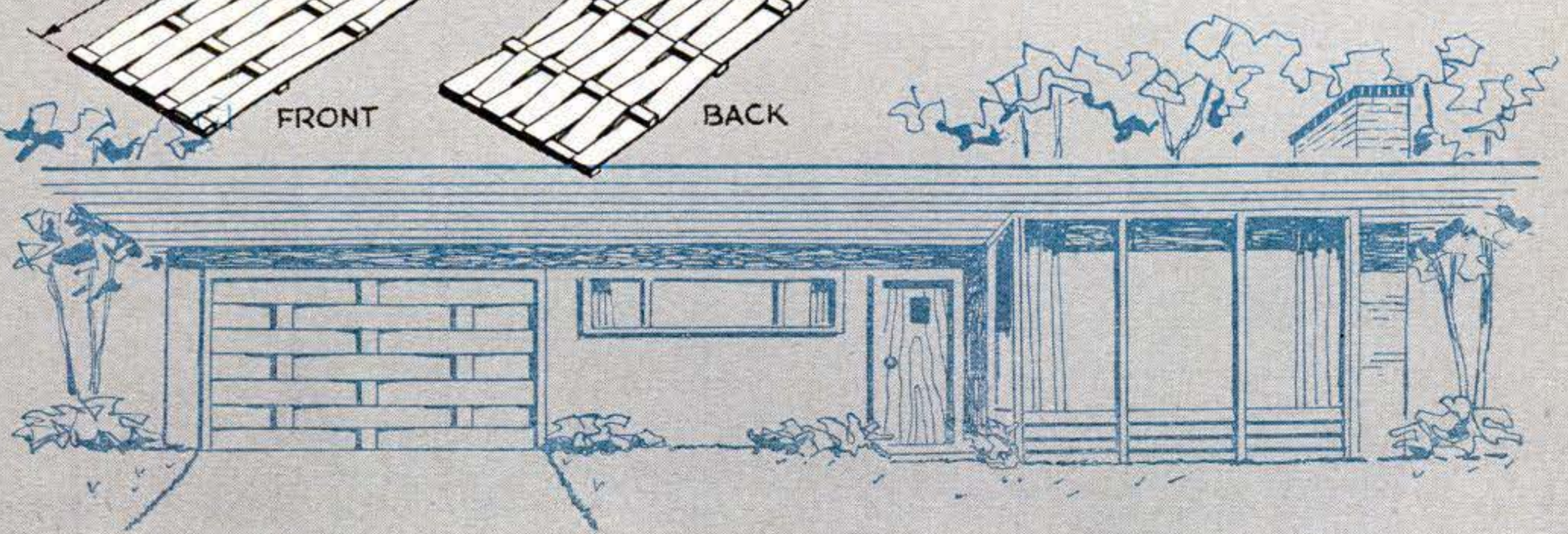


That You Can Build

Co., Paramount, Calif., a manufacturer of overhead-door hardware, and the magazine *Arts & Architecture*. The sketches were adapted from a booklet published by the hardware company.



For this basket-weave door you need five pieces of two-by-six 7′ long and strips of ¼″ Masonite. Glue and screw the Masonite to the wood stiles, keeping butt joints on the rear of the door.



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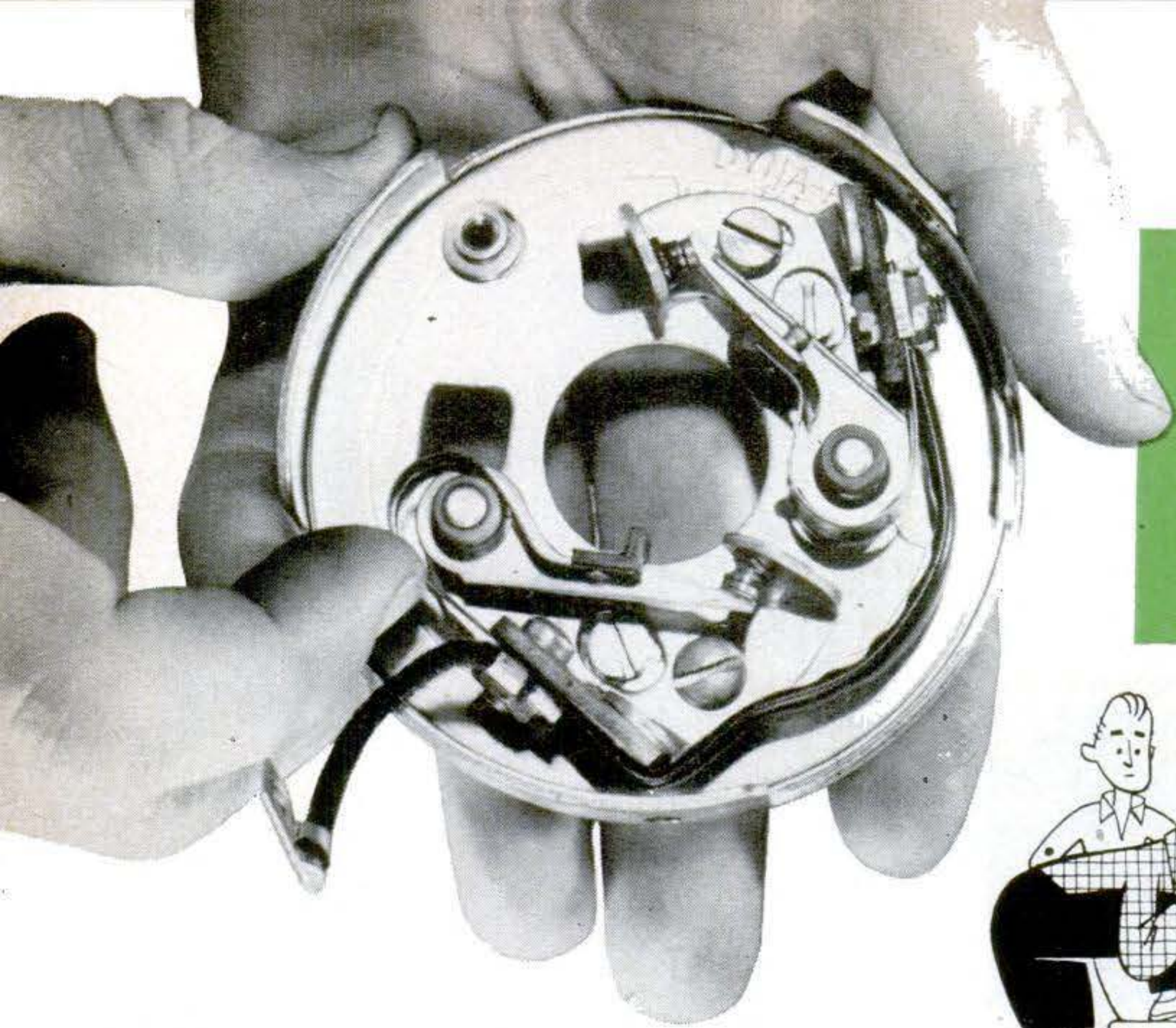
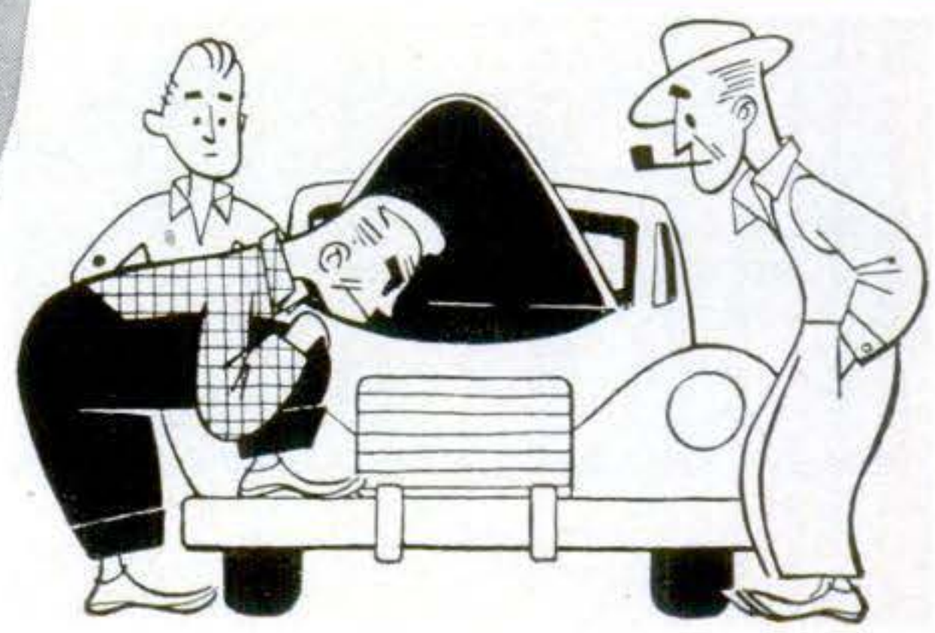


HERE'S THE GIMMICK the writer installed—an accessory ball-bearing breaker plate combined with dual breaker points. It costs less than $8. Insulated strip between the two sets of points is only change in basic wiring.



How to Get Hot Sparks Oftener

If you feel that your distributor falls down on the job, dual breaker points and a new plate may give it a shot in the arm.

By E. F. Lindsley

MAYBE you're like me. Maybe your friends often find you with your hat under the hood of your gasoline chariot figuring ways and means of making the blankety thing pay you better returns. So maybe you've wondered whether dual points and a ball-bearing breaker plate are a sound investment.

They are. Last fall, I installed both units in the distributor of my Buick and performance has improved noticeably. You probably could get the same results. But whether you do depends partly on the kind of car you drive. Ford and Auto-Lite distributors are not adapted to the unit I used, Dyna-Flyte dual points and distributor-plate assembly,* primarily because they either have dual points already or are not badly troubled by breaker and rotation problems. Most other cars, sixes and eights, could use the accessory dual points, a ball-bearing plate, or both the points and plate.

What are the benefits? If you answer yes to any or all of the following questions, the chances of a cure are better than good:

Has your engine ever stuttered its way through a high-speed missing session just when you were out to make time? Did it do this even though you had new plugs, properly gapped, and supposedly nourished by a hot spark through healthy lead wires and a good distributor cap?

Have you occasionally eased down from highway speeds to pass through a town and found the engine bucking so badly that it was miserable to drive under 30 without shifting into second?

Have you ever sensed something wrong with the idle when you stopped at a red light, yet when you stopped next time the idle was smooth as cream?

Does your car have acceleration "flat spots" where your pressure on the gas pedal

**Renberles Products, 16108 Roselawn Ave., Detroit.*

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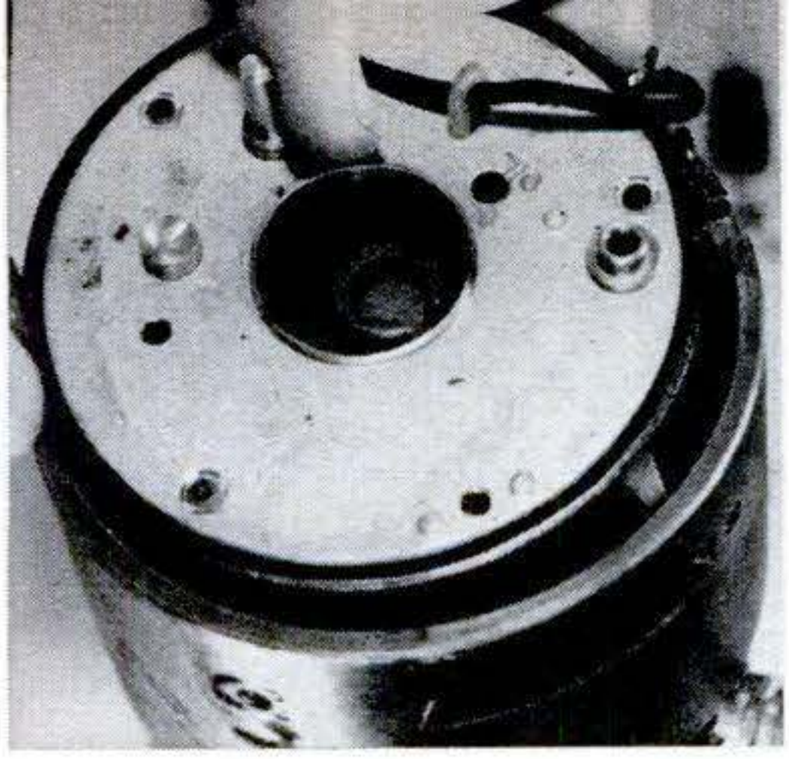
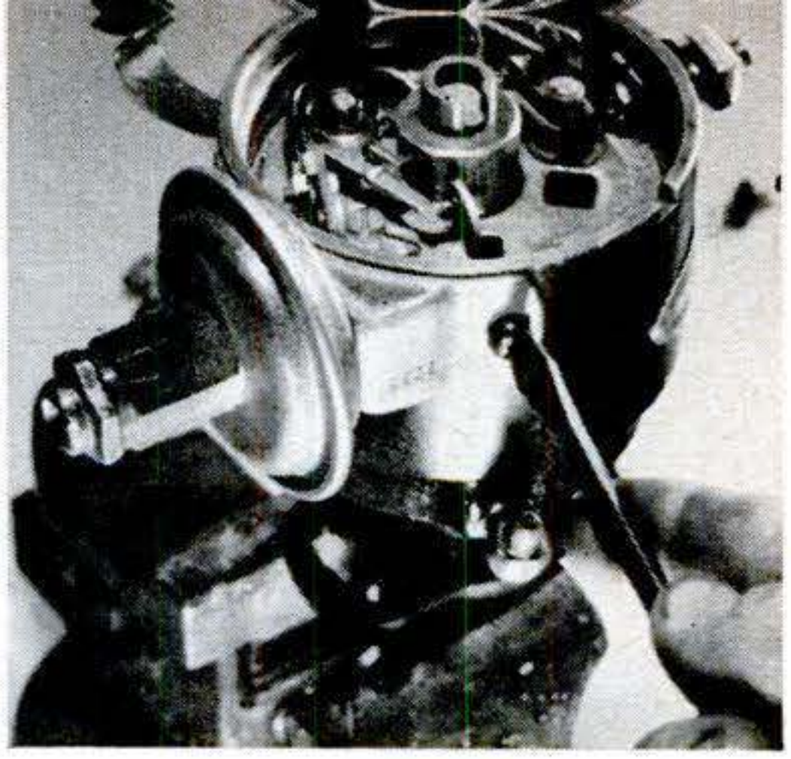


HOW UNIT IS INSTALLED. First step is to strip points and condenser from old breaker plate, remove the retaining screws, and lift out the plate. Then put in the new unit and attach the vacuum advance unit with new, slightly longer screws provided in kit.



tells you something should be happening but the speedometer lags lazily?

What's the cause? Such erratic engine performance as well as short-lived tune-ups all indicate a breaker-point system falling down on the job.

To understand why, think back to the lever usually identified as "spark" on cars of the Model T era. Nothing was automatic then about the advance and retard of the moment when fire jumped the spark-plug gap. You retarded the spark for starting, advanced her all she'd take while cutting along at top speed, and eased off while climbing a hill, until the knock was below frightening proportions.

Eventually, centrifugal advance systems were adopted. These have weights, like the flyballs on a steam-engine governor, to turn the breaker cam against rotation as the engine speeds up. This spark governor retards the timing to a reasonable point for starting and advances it as you pick up speed.

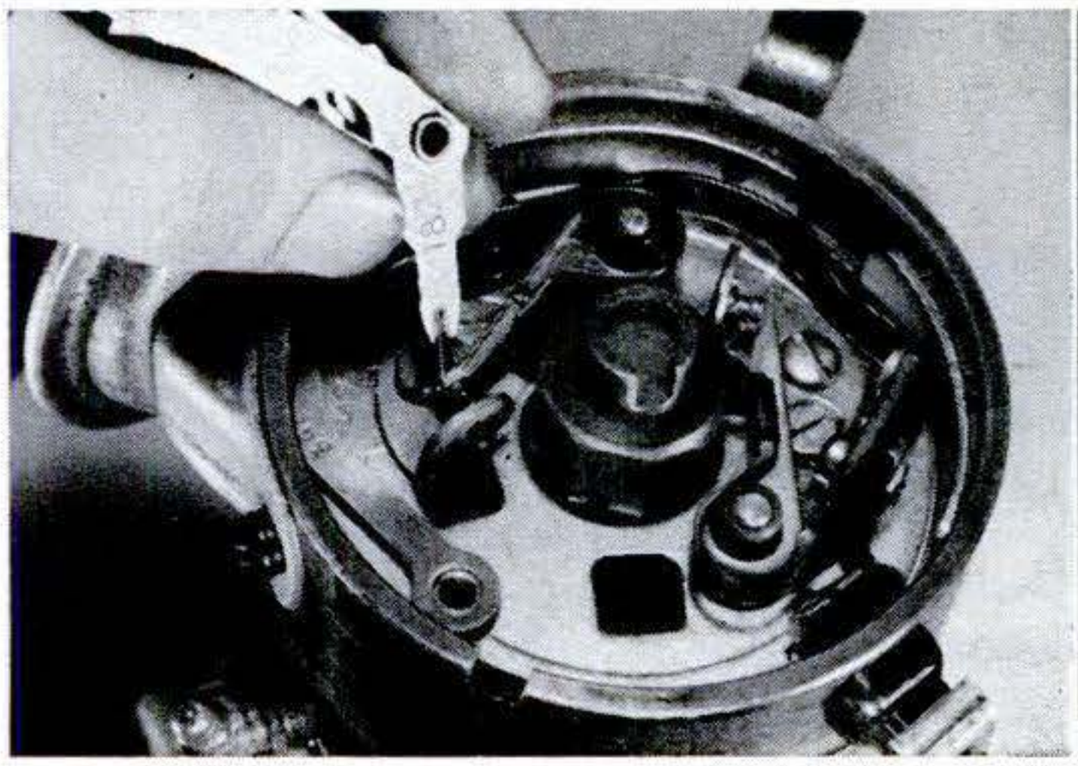
High-compression and high-performance demands, however, complicate the work a centrifugal control is expected to do, especially at high speeds. You get best full-throttle, full-load performance with advance to a certain point. Any more would be inefficient and destructive. Yet at part-throttle cruising, considerably more spark advance would be an advantage.

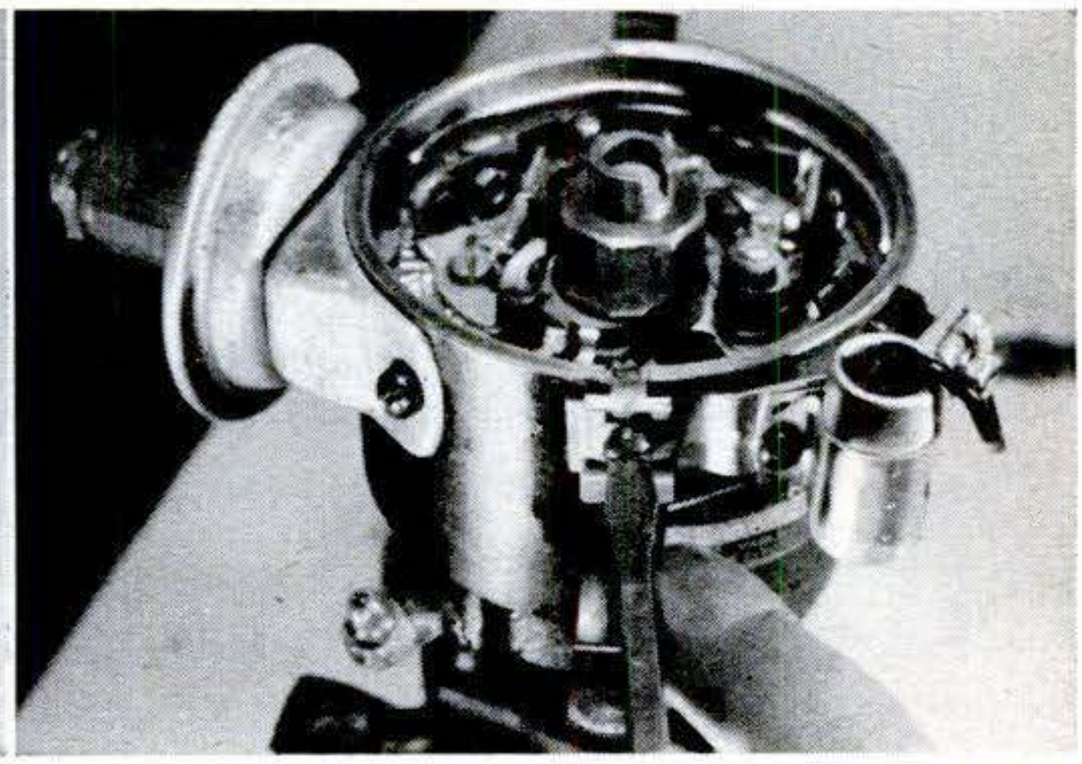
Here's where a vacuum advance comes in. Operated by the varying vacuum in the intake manifold, it provides the additional advance in the middle speed ranges that the centrifugal mechanism cannot give.

How vacuum advance works. In most cars, the vacuum diaphragm moves a link arm back and forth to rotate a movable breaker plate. If the breaker plate rotates as it should, if the spring pulls it back to its designed location when vacuum is low, your engine will function smoothly.

But here's the rub—and rub is the right word. Through wear, dirt, manufacturing variations and sheer perversity (or so it seems), the breaker plate does not always move as advertised. Consequently, the odd behavior which you sense in the driver's seat reflects the misbehavior of the vacuum advance system.

One of the original methods of mounting a breaker plate consisted of providing a groove inside the distributor housing to serve as a race for small steel balls supporting the plate. Unfortunately, wear in the groove and balls eventually limits movement





ACCURATE POINT CLEARANCE is vital. Feeler gauge of wire-type shown is okay with new points. If points are worn, dial indicator is better. Condenser must go outside. Maker recommends condenser of higher capacity, but writer found original worked well.

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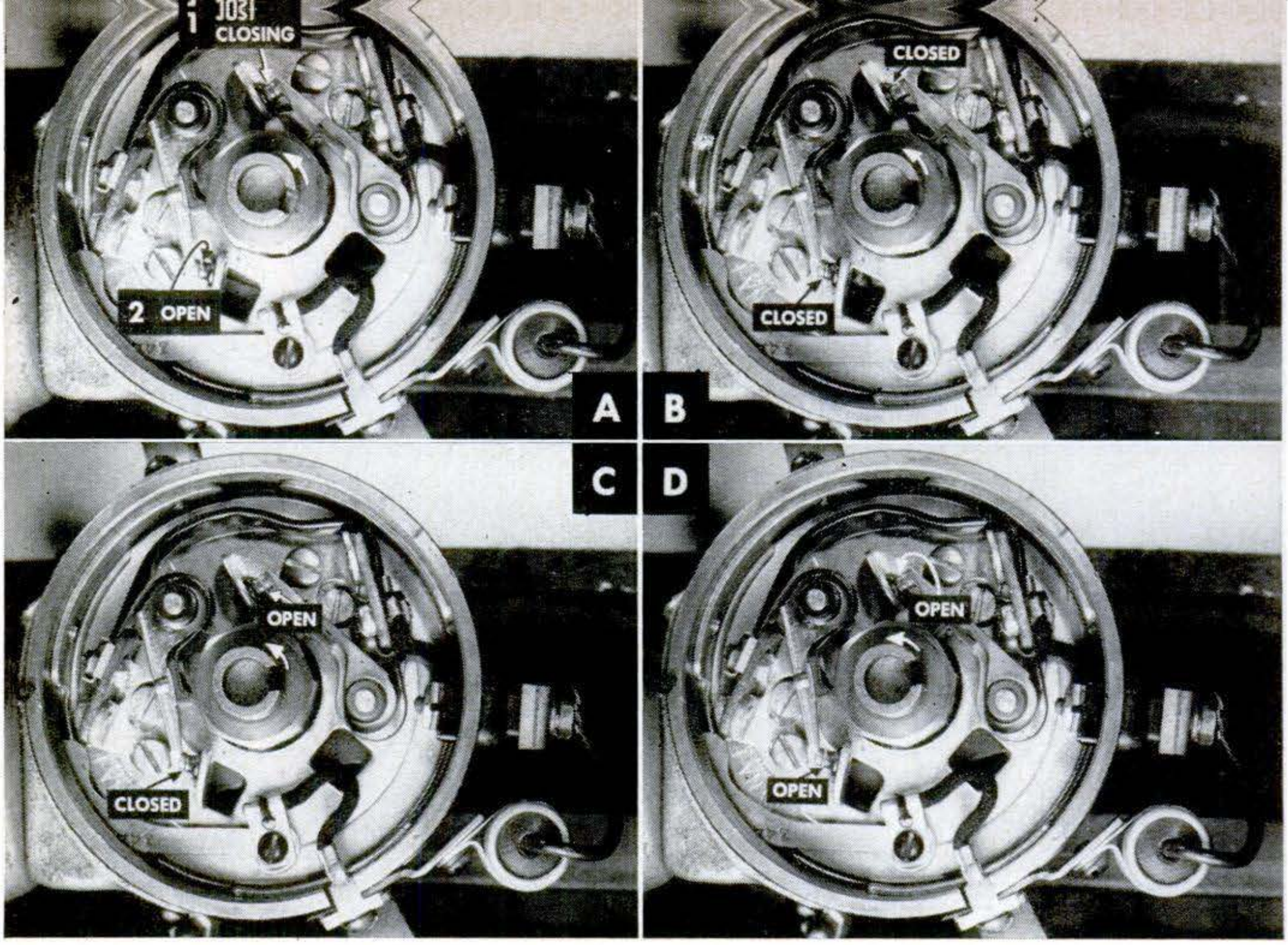

HOW DUAL POINTS WORK. By lengthening the dwell angle, dual points give coil a longer period to build up a charge, thereby assuring a hotter spark. Here, in photo A, points at left (No. 2) are open and plug has just fired, and points at right (No. 1) are just closing. In photo B, the left points have also closed—and the dwell period begins. In photo C, points 1 have opened, but no spark occurs because points 2, which control the timing, are still closed. In photo D, the second points are open—and spark jumps the gap.

of the plate. About three years ago a sliding bearing replaced the ball race. This newer unit is longer lasting, but still leaves much to be desired in breaker movement.

It should be noted here that the type of distributor I am talking about can be recognized by the vacuum unit attached directly to the distributor housing. On types such as that found on the Chevrolet, the vacuum unit is mounted to one side of the distributor and just pulls and pushes the entire distributor around.

What's the cure? So much for the symptoms of breakeritis. The cure is a breaker plate so mounted that it moves with absolute freedom and just the proper amount of drag to match the calculated characteristics of the spring and vacuum diaphragm. The breaker plate that I installed is a precision device with a nicely machined bearing race and about a jillion small steel bearings to carry the load with beautiful smoothness.

One poke with your finger will convince you just how slick it is. Install one and drive the car, and you'll be even more convinced. If you are content with a single breaker point, this ball-bearing plate can be used in the factory-installed distributors of a long list of cars.

Why dual points? To appreciate the advantages of making this switch, you must consider just what a tremendous job we demand from a single set of points and an ignition coil at high speeds when the engine is turning up around 4,000 r.p.m. or more.

At this speed, each cylinder fires 2,000 times each minute. Multiply this by eight cylinders and you find that the coil is asked to charge and discharge 16,000 times each minute. Even at the speed of electrical energy, this isn't easy. To get a hot, intense spark, the coil needs a full charge of current long enough to saturate the primary. This build-up must take place during the fraction of a second the points are closed. Anything we can do to help along this charging of the coil improves high-speed ignition.

The period of time the points are closed is measured in degrees of cam rotation and is usually called dwell angle. Dual points increase the dwell angle, giving the coil a longer time to build up a charge. Second,

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dual points reduce the amount of work each contact surface has to do. Thus, your points should last longer.

Installing the unit. Although dual points and the ball-bearing plates can be installed without removing the distributor, you'll find the job easier and get better results by clamping the works in a shop vise. Removal takes only a few minutes. If you are careful to watch exactly where the rotor on top of the cam is pointing as you lift out the distributor, there should be no difficulty in dropping it back and engaging the drive gear and oil-pump drive tang.

Complete cleanliness and secure connections, second nature with a good mechanic, are the main things to watch for. Otherwise, the directions that come with the parts are easy to follow.

Adjust the point clearances very carefully, drop the distributor back in its opening, and time the engine on the nose. If you don't have a timing light, you can get by with one of my trick solutions.

Timing tricks. For timing, I normally use an old tail-light bulb with a couple of lengths of doorbell wire soldered on. I clip one wire on the hot terminal of the battery, and the other I hook or wedge gently on the breaker point. With duals, you time on the second point to open.

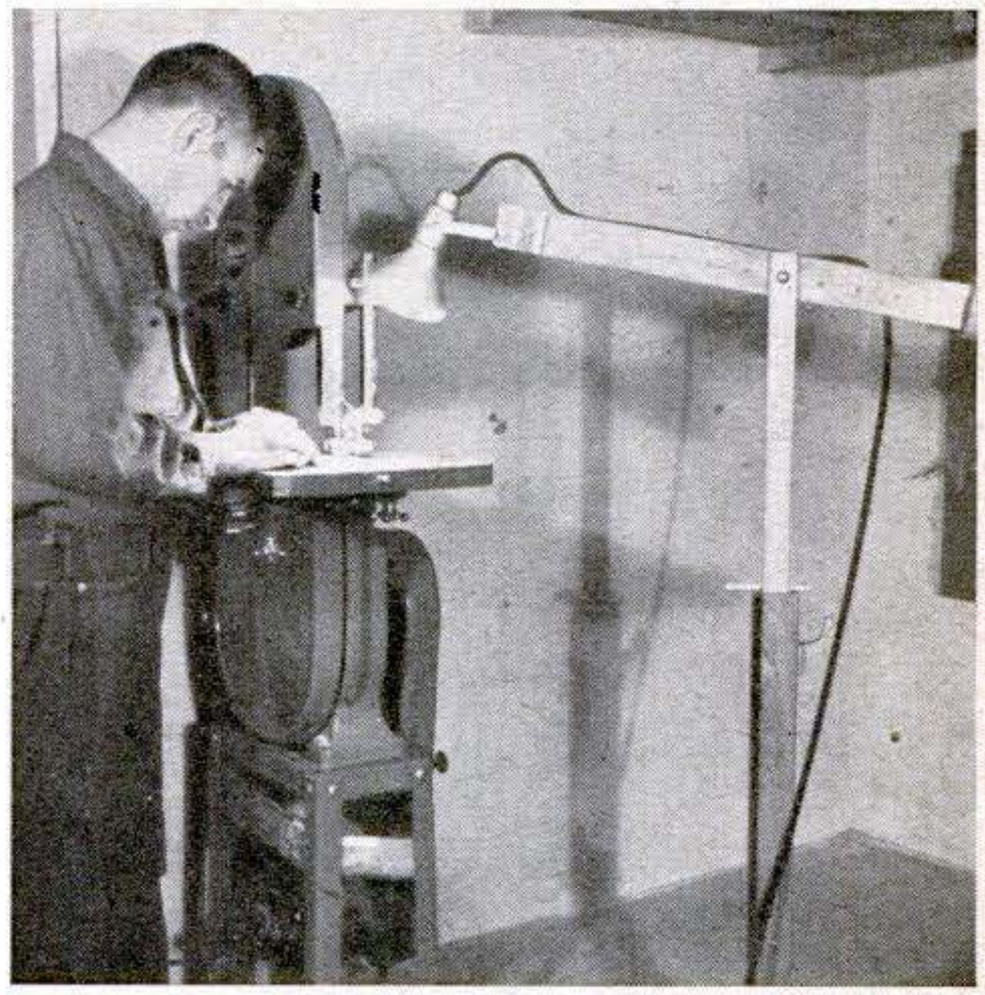
Then, with the engine turned so the timing mark is lined up with its pointer and the distributor rotor in position to point to No. 1 spark-plug wire when I clip the cap back on, I carefully turn the distributor body until the light just goes out as the points open. I then tighten the distributor hold-down screws and the job is done.

Another version of the same trick is to turn on the ignition, with the primary wire connected from the coil, and have someone watch the ammeter. The slight discharge through the coil will show on the ammeter. As the points separate, the needle will flick back to zero. Still another timing trick is to take the high-tension lead from the coil and, with the ignition on, hold it about ⅛″ from the engine block. As the points break, a spark will jump. If the timing marks are lined up, the engine is in very close time.

I have checked all these methods carefully with precision-timing equipment. If you are careful, they seldom will err by more than 1°. END

Next Month: An expert will tell you about spark plugs. Even racing drivers sometimes install the wrong plugs the wrong way.

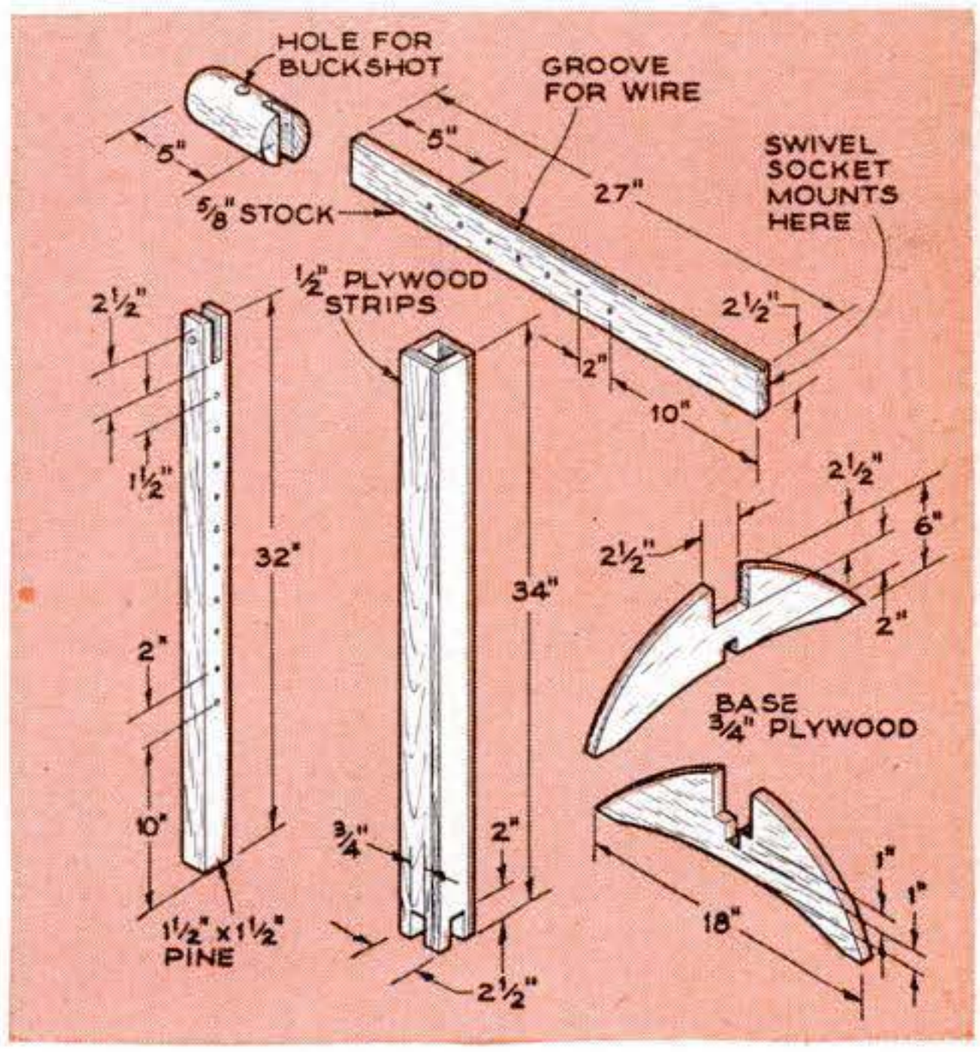
Portable Spot for Shop



This portable light stand can be quickly swung into position wherever needed.

Scrap strips of plywood make the hollow column and a length of pine telescopes into it, permitting raising or lowering the light to the best height. A plywood arm, counterbalanced by a wood turning drilled out and filled with buckshot, supports the light. Both the arm and the telescoping shaft are drilled along their length. In the shaft, these holes are for a ¼″ dowel pin that holds it at the desired elevation. The holes in the arm permit extending it farther out from the stand.

Two types of bulbs are best suited to the light stand: the 150-watt reflector flood for general illumination of machines and the 150-watt spot for concentrating light on very exacting work.



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Retaining Walls

...Why, Where, How

A few rocks or logs can keep your lawn from washing, give you a level terrace on that sloping back yard.

By Sheldon M. Gallager

YOU can make the good earth better. The way it comes naturally may not provide that level patio you've been wanting, a built-in driveway in just the right spot, or a lawn that doesn't wash away with every rain. For all these, you need a wall to hold back earth—either to make something you want or to keep something you have.

What kind of wall? Masonry walls—cast concrete or cemented stones or blocks—are strongest but take the most work. They go best along a boundary, where a straight wall is needed, or to carry out the lines of a house, as for an adjoining terrace.

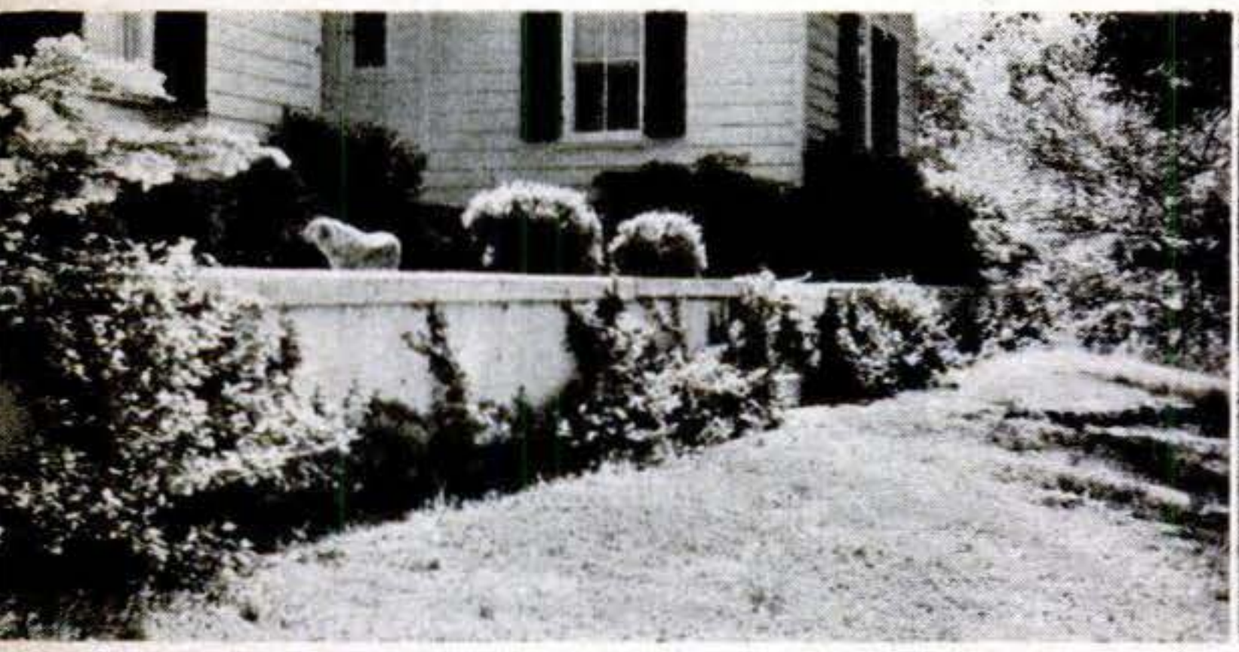
Uncemented walls—loose stones, logs, rock gardens—are cheaper, more informal, make picturesque, free-curving walls where precise construction is not needed.

Are footings needed? Not for uncemented walls—they give when the ground heaves, settle back again without harm. Masonry walls, however, will crack unless carried down well below the frost line—at least 2′ in most localities. They should rest on a concrete footing at least 1′ thick and 1′ wider than the wall it supports.

Don't forget drainage. Loose walls drain themselves, but solid walls trap water that may freeze and heave. This should be allowed to drain by inserting pipes every 6′ along the wall's base.

On this and the next five pages are a score of walls to fit every need—whether your problem is a mountain or a molehill.

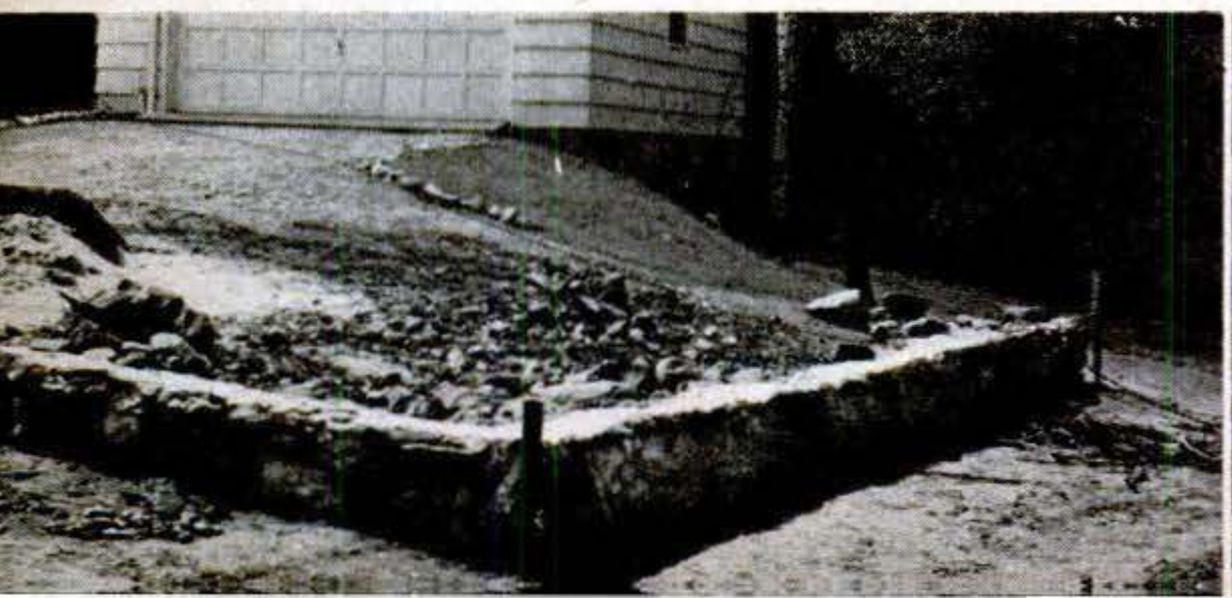
Five ways that retaining walls can help improve your home



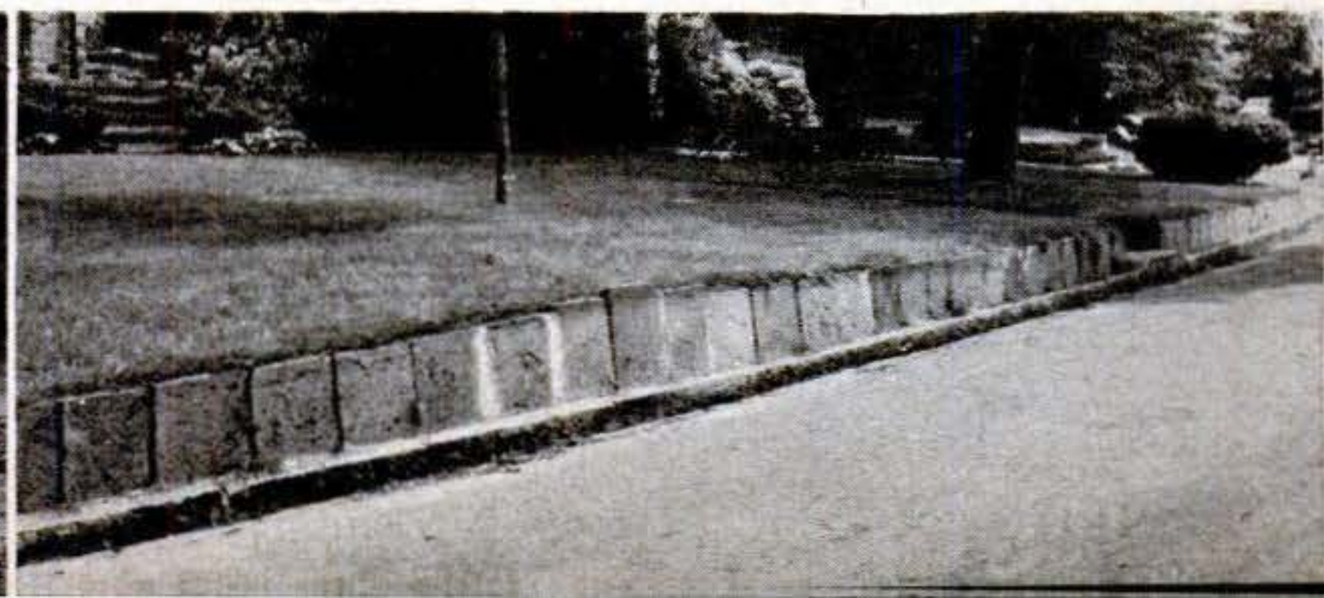
High foundation is screened by wall that makes house look lower, also provides level patio and small garden on a problem grade.

Bad erosion is stopped by piling loose stones against bank. Here stones do not actually hold earth, simply keep it from washing.

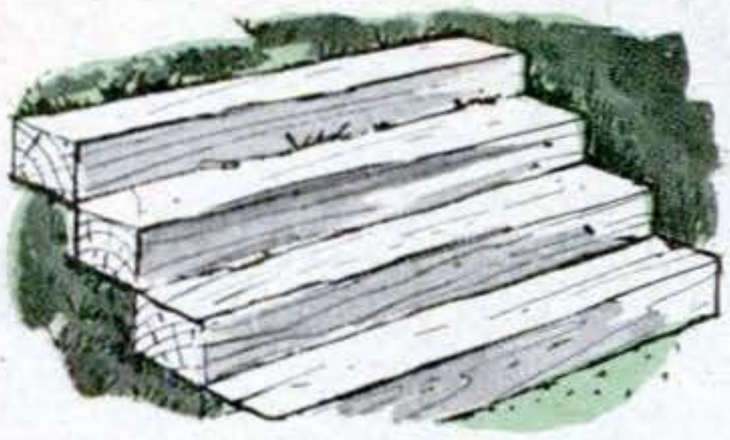
Built-up grade converts unusable slope into level area, here for a driveway turnaround. Wall is built first, then backfilled with earth.



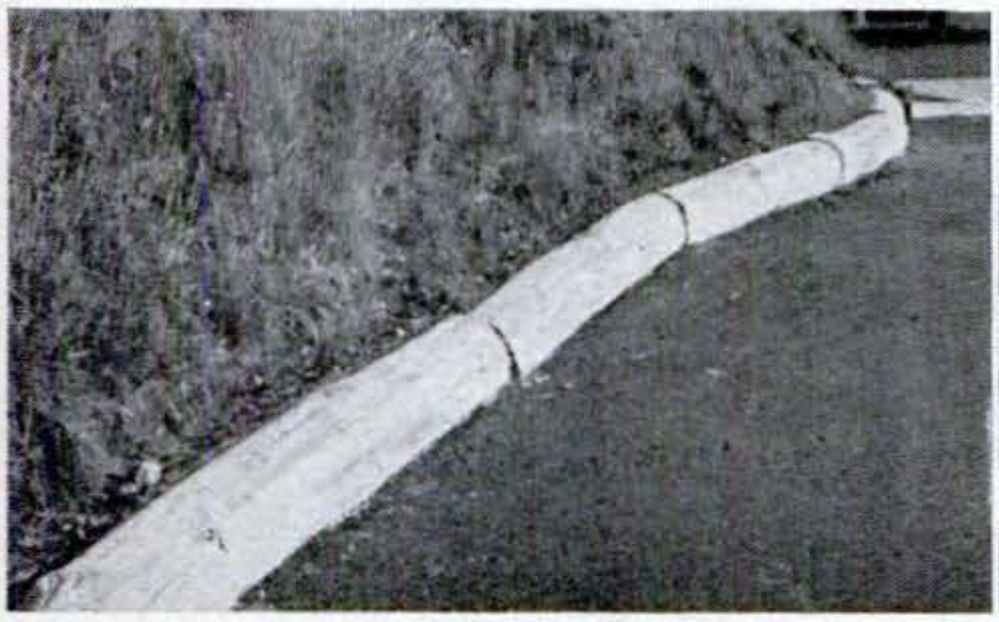
Leveled lawn, made possible by edging of slate, is easy to mow, can't wash into street. Slabs are set into ground below curb.

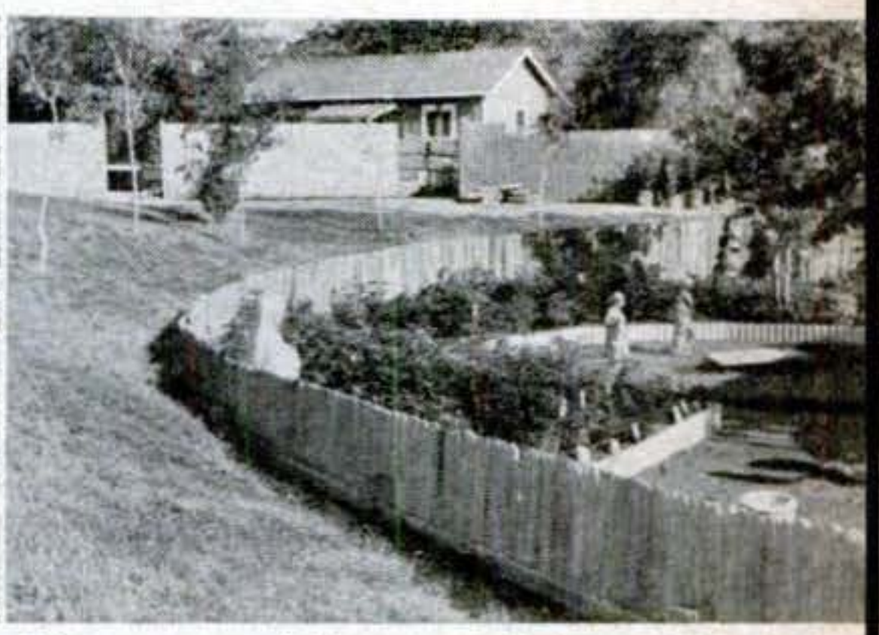


Walls of wood are cheap and easy

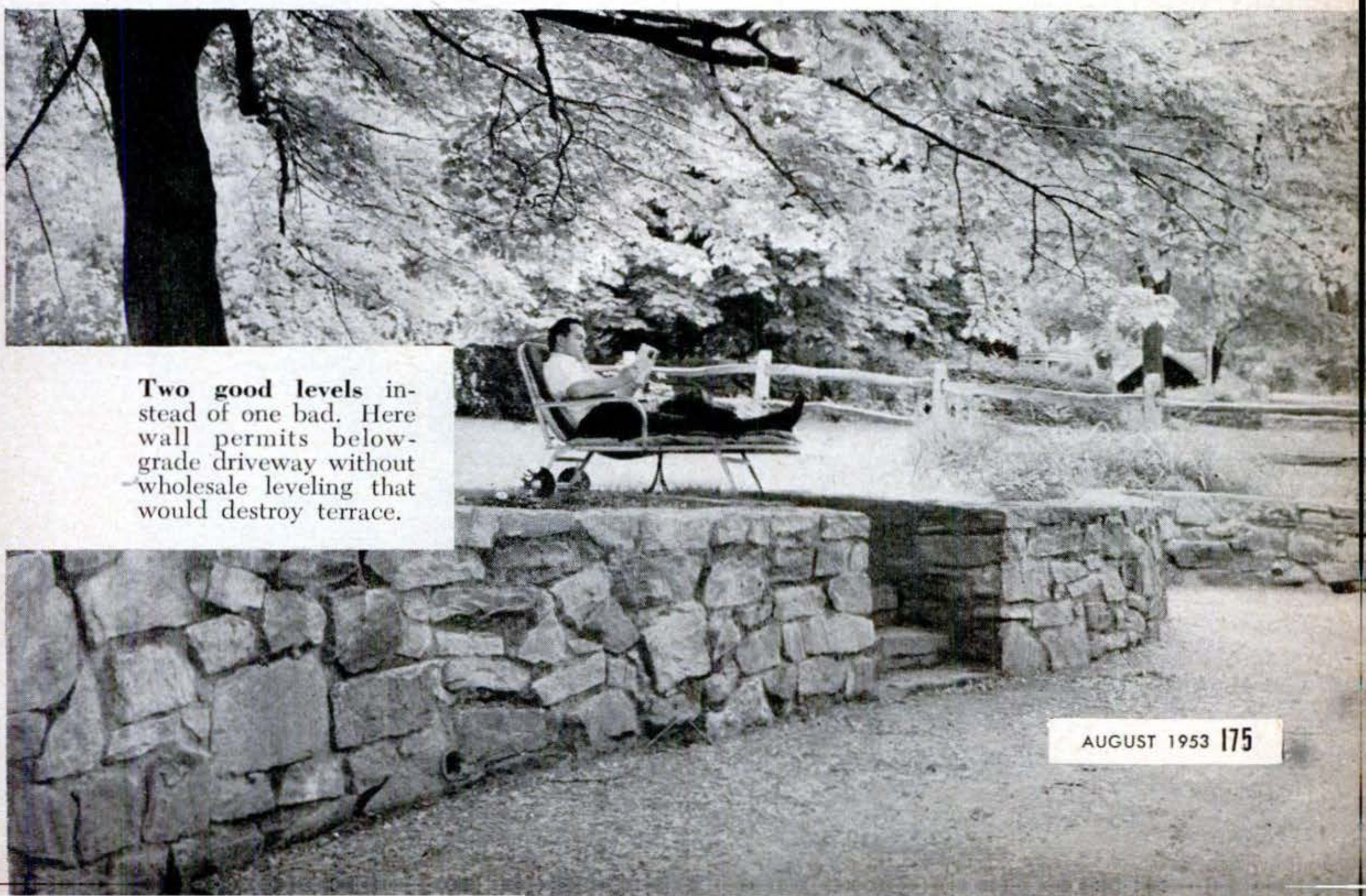


Old railroad ties, usually free for the taking, give rustic look, hold well because of their weight and last for years. Ties can be stepped to hold earth on a slope (above) or stacked for straight wall (right).





Logs laid in rows (left) are easy way to keep low bank from washing into street or driveway, won't harm tires if accidentally bumped by car. Painting them white adds trim appearance, outlines driveway at night. Where looks don't matter, a barricade of logs (center) will hold a heap of dirt. Here several logs are driven into ground vertically for support, then others are stacked crosswise behind. At right, closely spaced wood stakes double as fence for privacy and wall to hold bank. Large posts driven down behind fence help take strain.

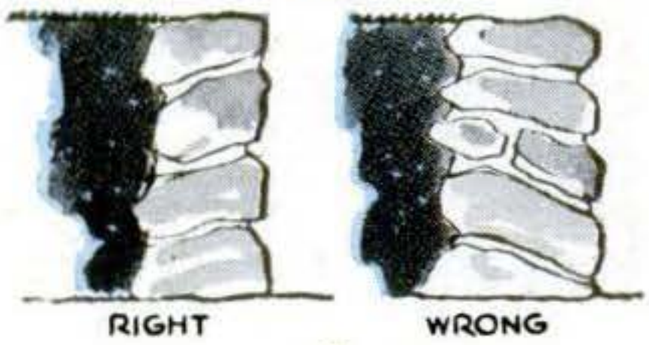


Two good levels instead of one bad. Here wall permits below-grade driveway without wholesale leveling that would destroy terrace.

Walls...

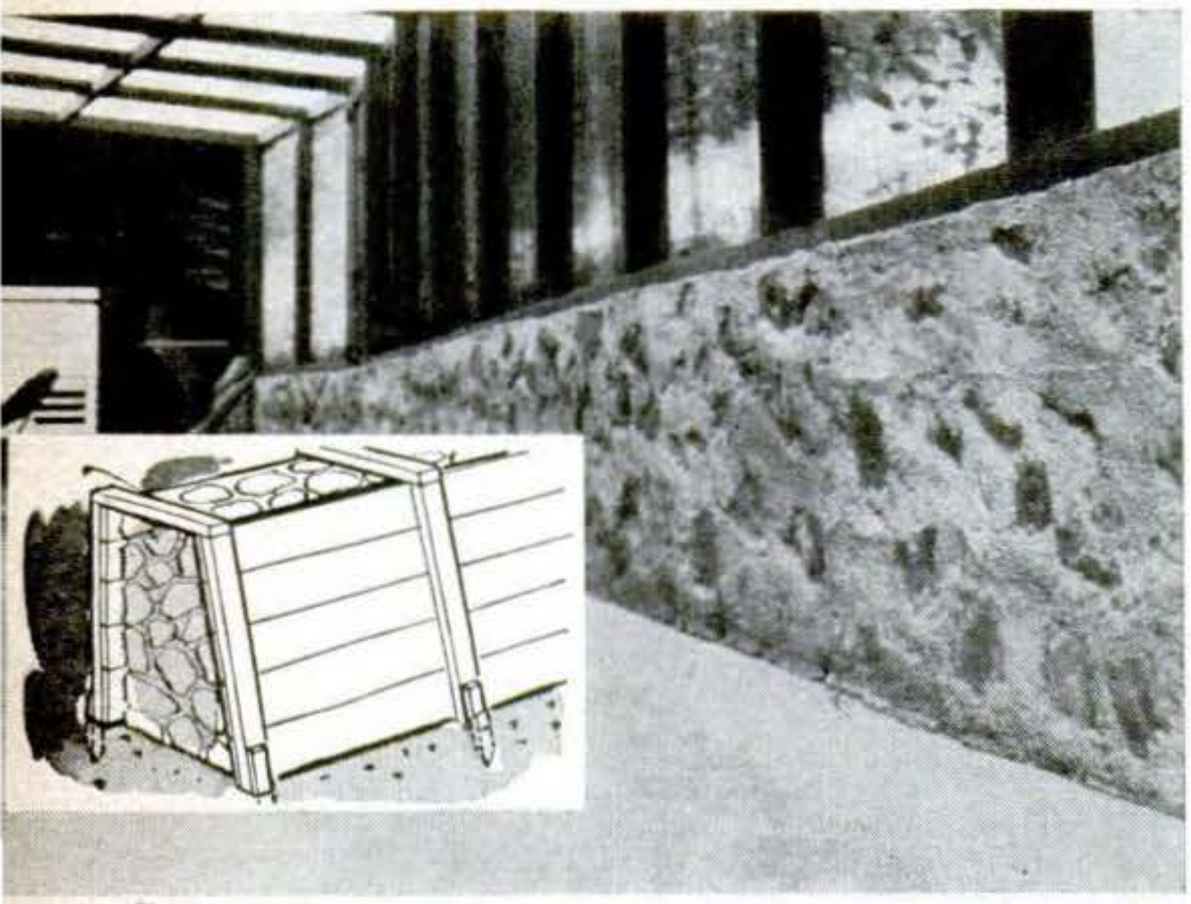
Trick with stones and cement makes wall that looks dry-set

Pocket of stones is set up and washed (left), then cement is poured in and more rocks plopped on top (center). When cement sets, next pocket is built up, 2′ to 3′ at a time, and process repeated. Final hosing (right) removes cement that oozes through to face, and result is wall that looks dry-set. Sketch shows how stones slant down at back to prevent heaving.



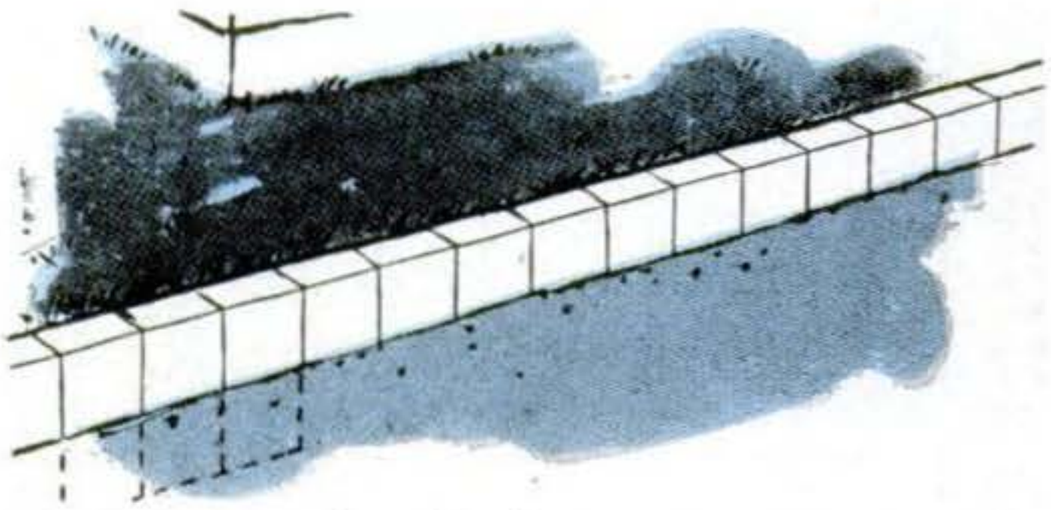
Two easy ways to cement stone

Rough wall is made by simply piling up stones and sloping cement in around them. Wearing gloves, work cement into cracks by hand, and leave ragged instead of troweling.

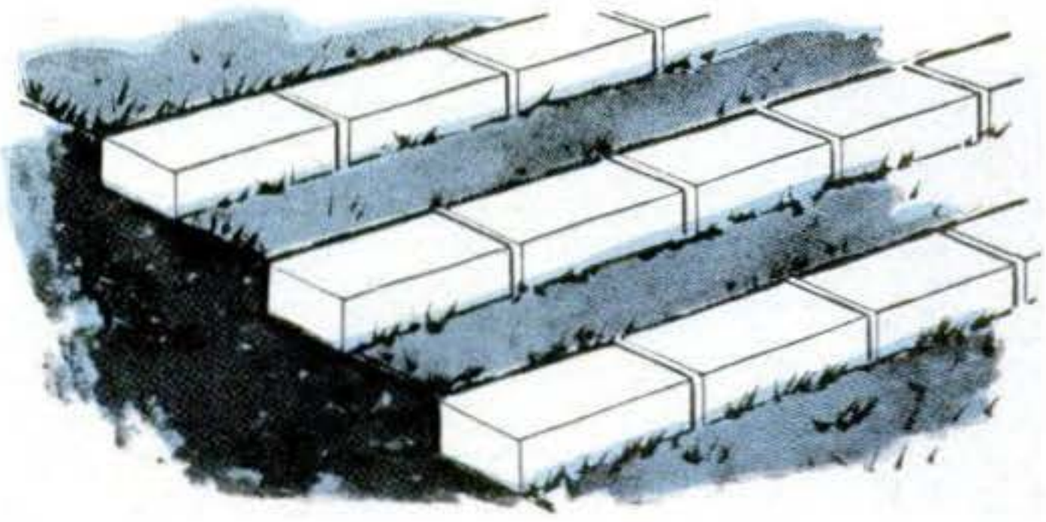


Textured wall can be made by building form of planks and two-by-fours and then piling in rocks and cement at random. Form eliminates careful fitting of stones, insures straight, flat surface. Wall should be at least 8″ wide at top, ⅔ as wide at bottom as wall is high.

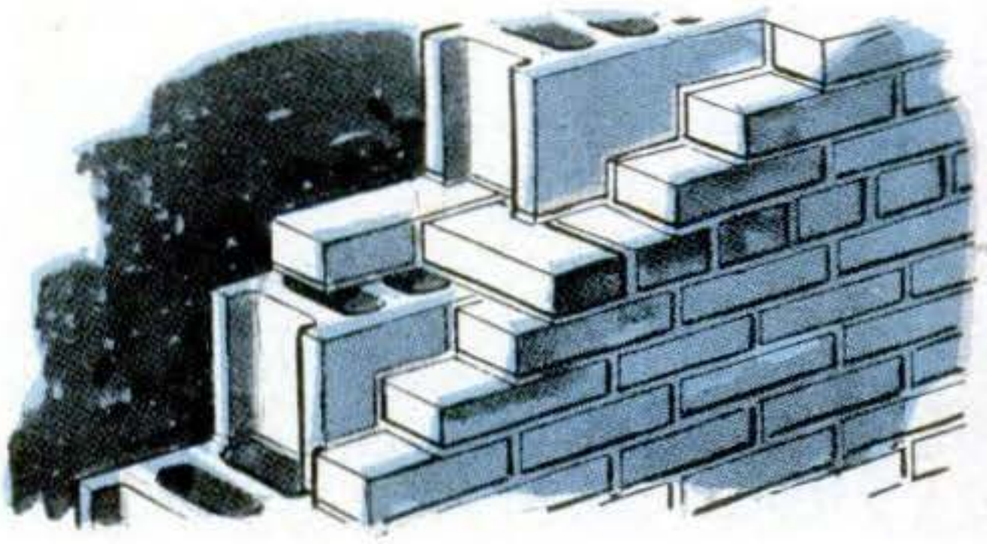
Old bricks are rustic, cheap



Used bricks, bought for penny apiece, make low edgings for house plantings or driveways. Turn bricks on end, embed half in ground.



Bricks stepped in rows will hold earth on a slope without requiring cement. Old mortar left on looks rustic, helps bricks grip ground.



Brick wall can be made by backing up facing with concrete blocks for strength. Run every fourth course of bricks back over blocks.

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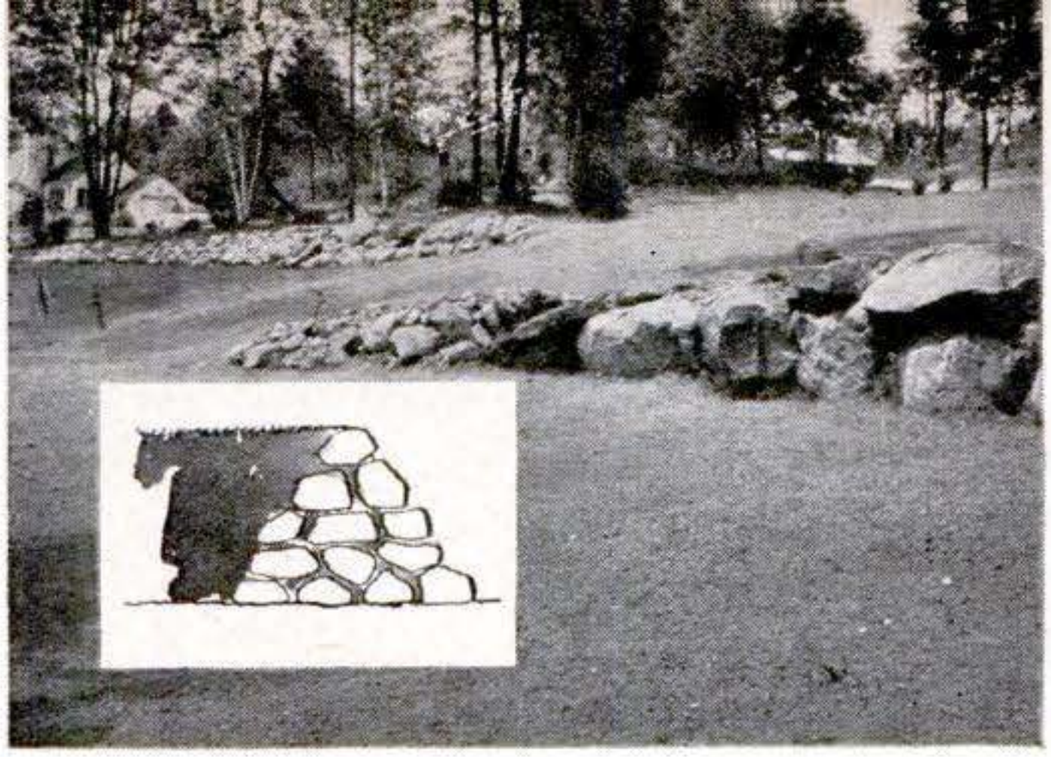
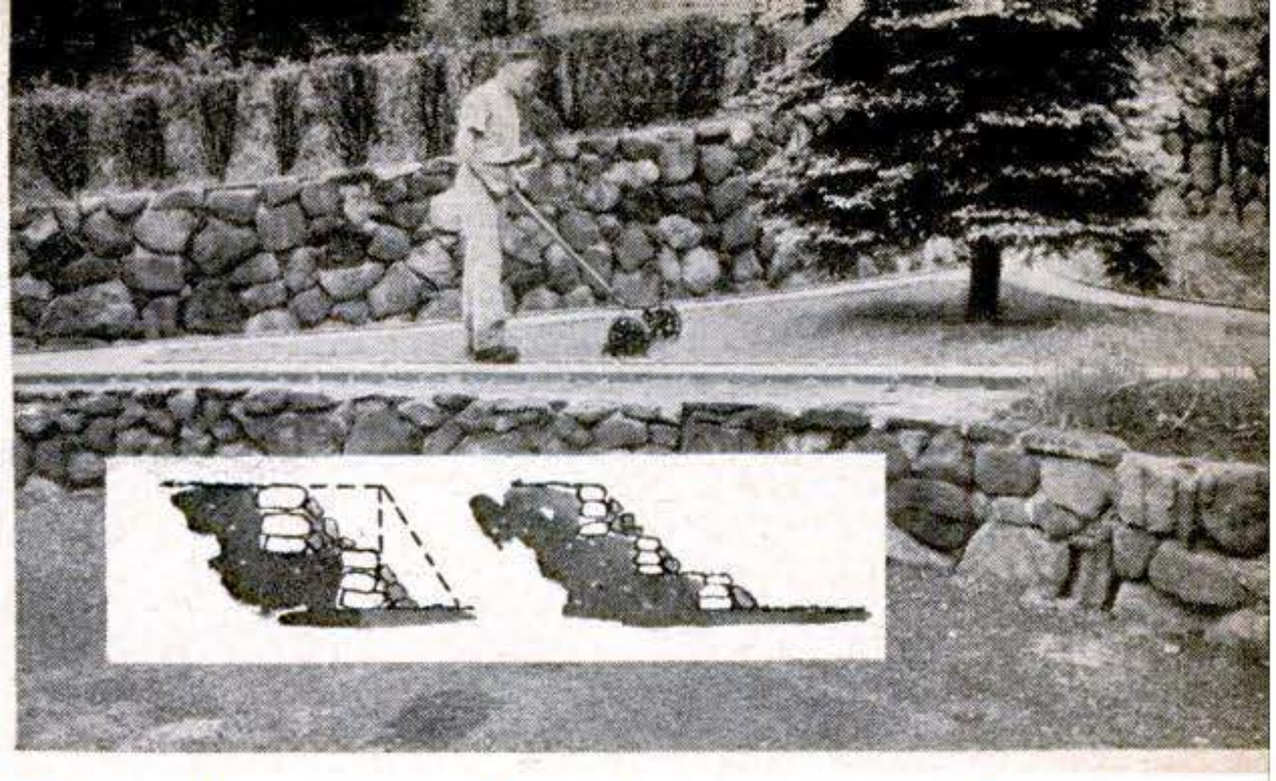


Loose stones need no cement

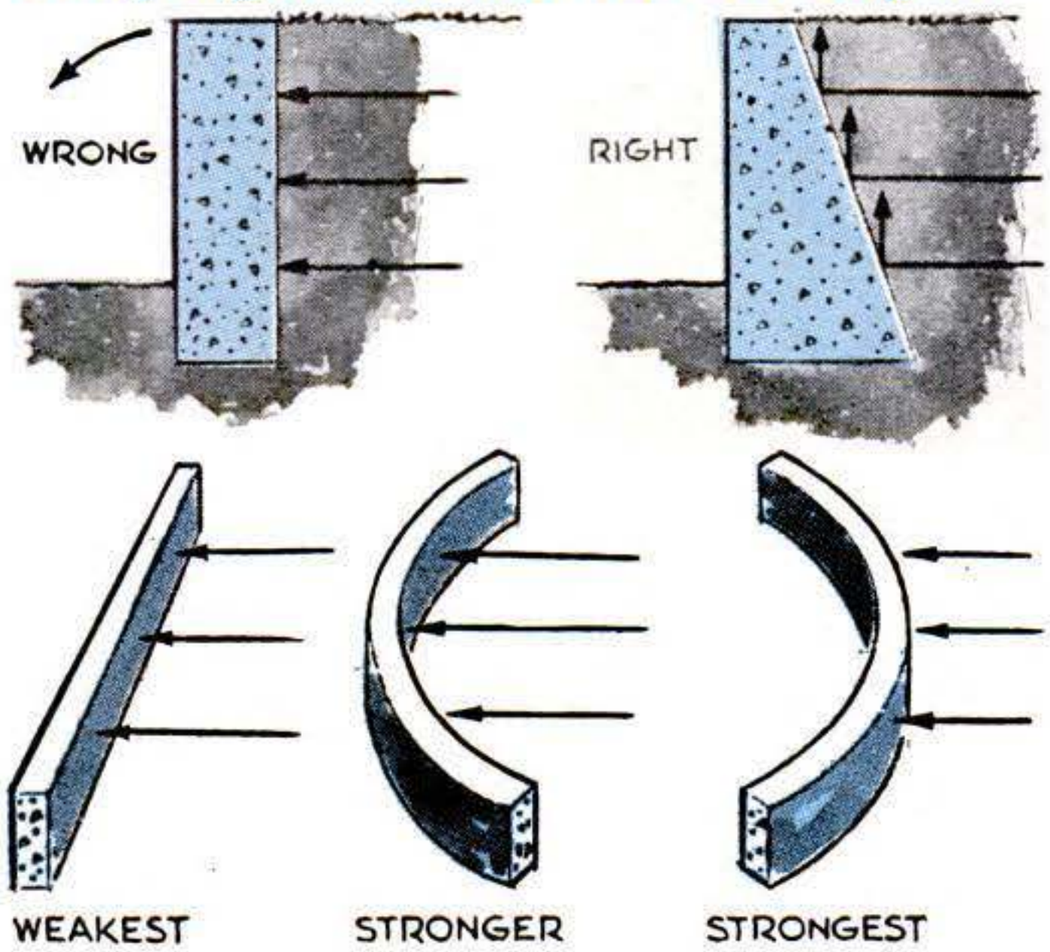
Loosely piled rocks will hold up to several feet of earth without cement. Choose square or angular stones instead of round ones that might roll, and stack in triangular sections (sketch). Later, earth can be packed into cracks and flowers grown to make a rock garden.



Stepping your land saves work

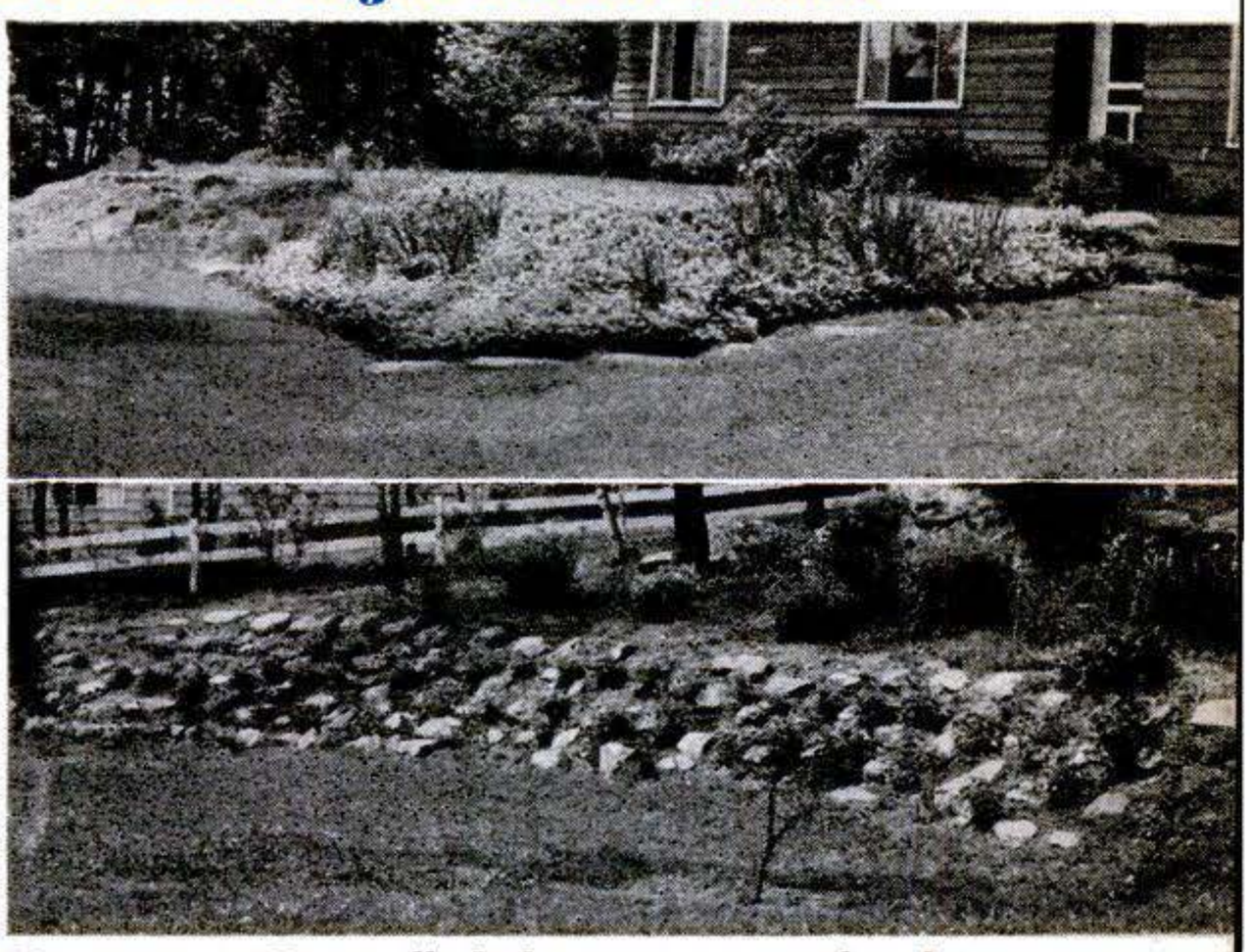
Several small walls are easier to build than one big one, look better and eliminate danger of children falling. Sketch at left above shows how fill is saved by stepping. By both cutting and filling (sketch at right), you can use earth removed from high ground to build up low.

Shape your walls for strength



Slope-backed wall (top right) deflects frost-expanded soil upward, is less likely to push out than straight wall that takes full brunt. At bottom, out-curving wall is stronger than straight, but in-curving one is strongest of all —arch effect keeps pressing joints tighter.

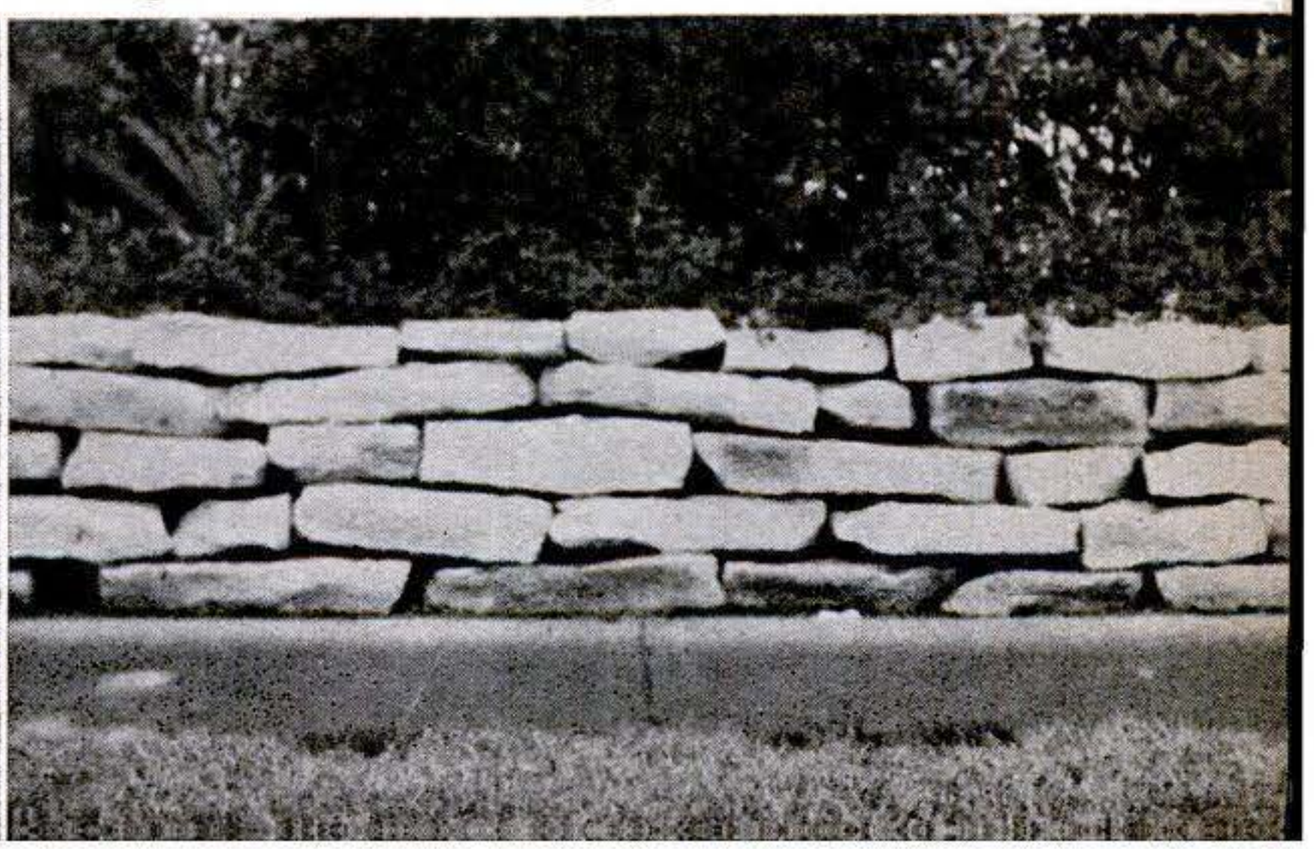
Use a rock garden as a wall



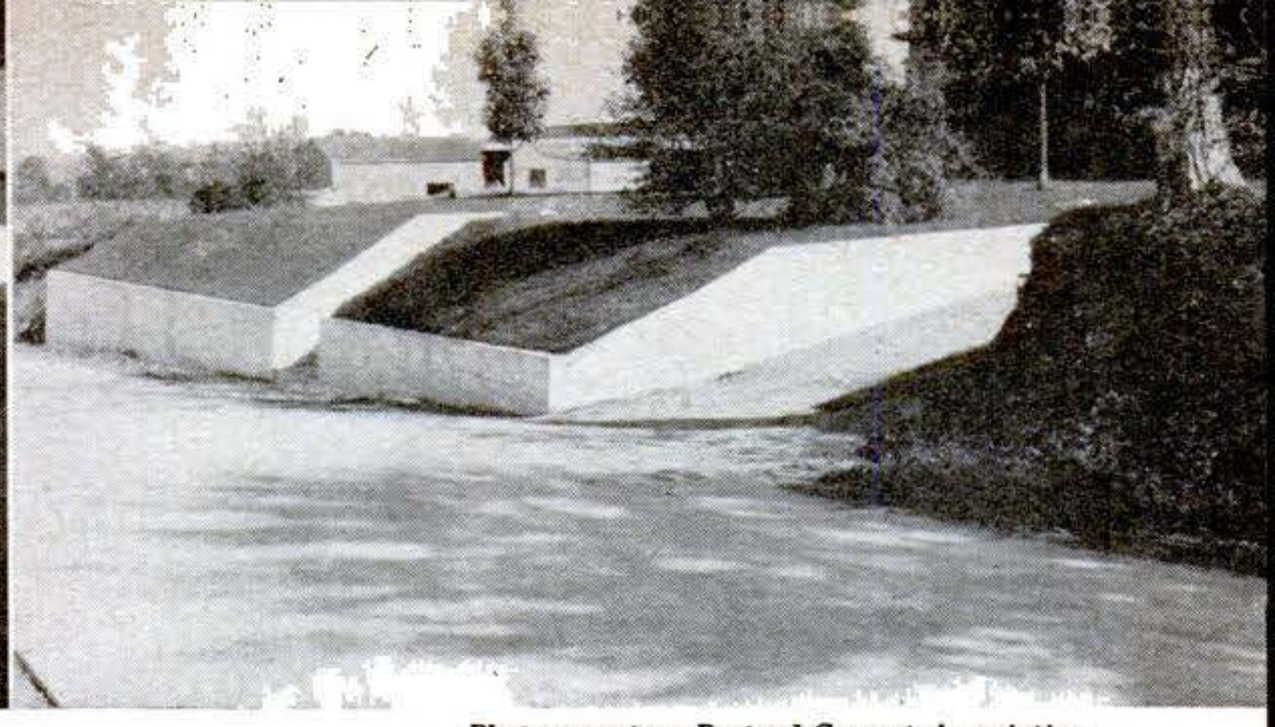
Sloping walls, called breast-type, take least work of all, are often more picturesque where straight wall is not needed. Slope at top above is simply natural angle of soil, about 37°, held in place by plantings. By adding stones (bottom), slopes can be built up to 45° or 50°.

Fitted stones make informal walls, can't crack or heave

Dry-set walls, laid up without mortar, must be carefully fitted, but need neither footings nor drains since they let water escape and give when ground heaves. At left below, large irregular-shaped rocks are first set up, then cracks are chinked with small stones. Wall at right needs no chinks because flat slabs fit well, get strength from interlocking.

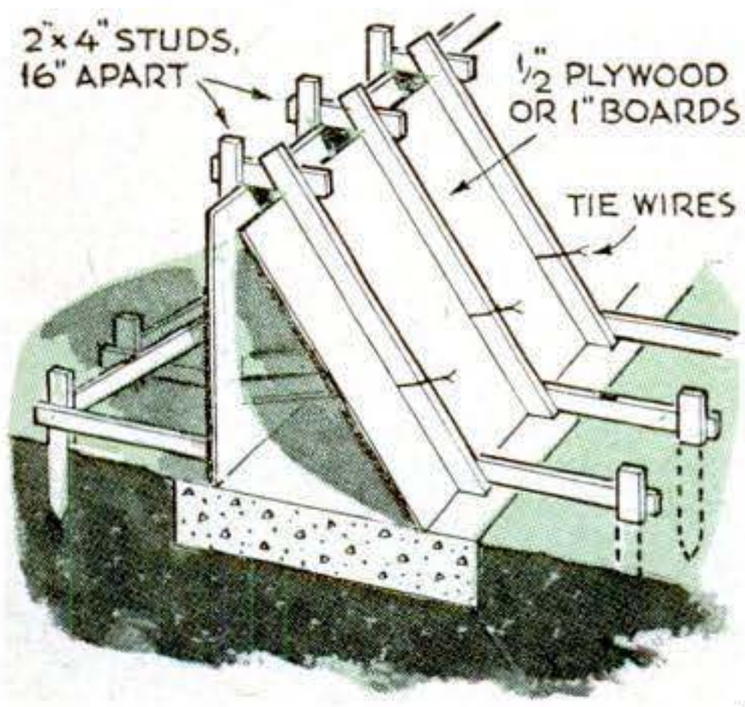


Walls...

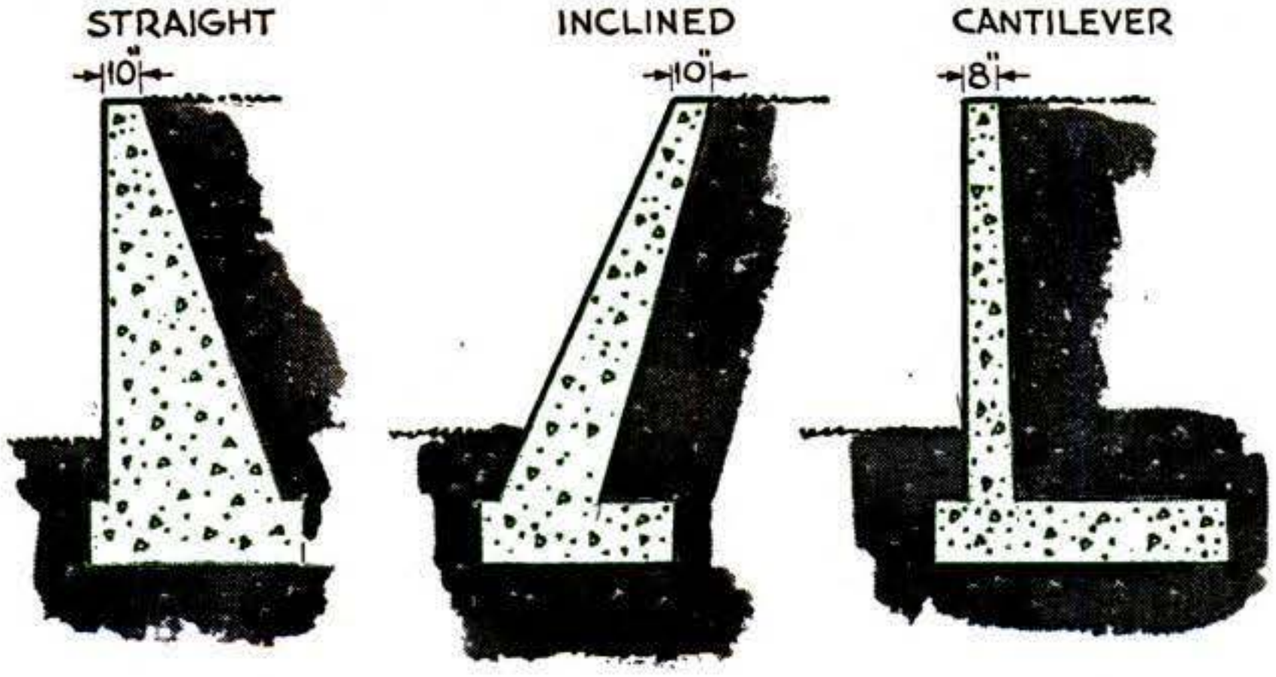


Photos courtesy Portland Cement Association

Poured walls are strongest, can be made in three shapes

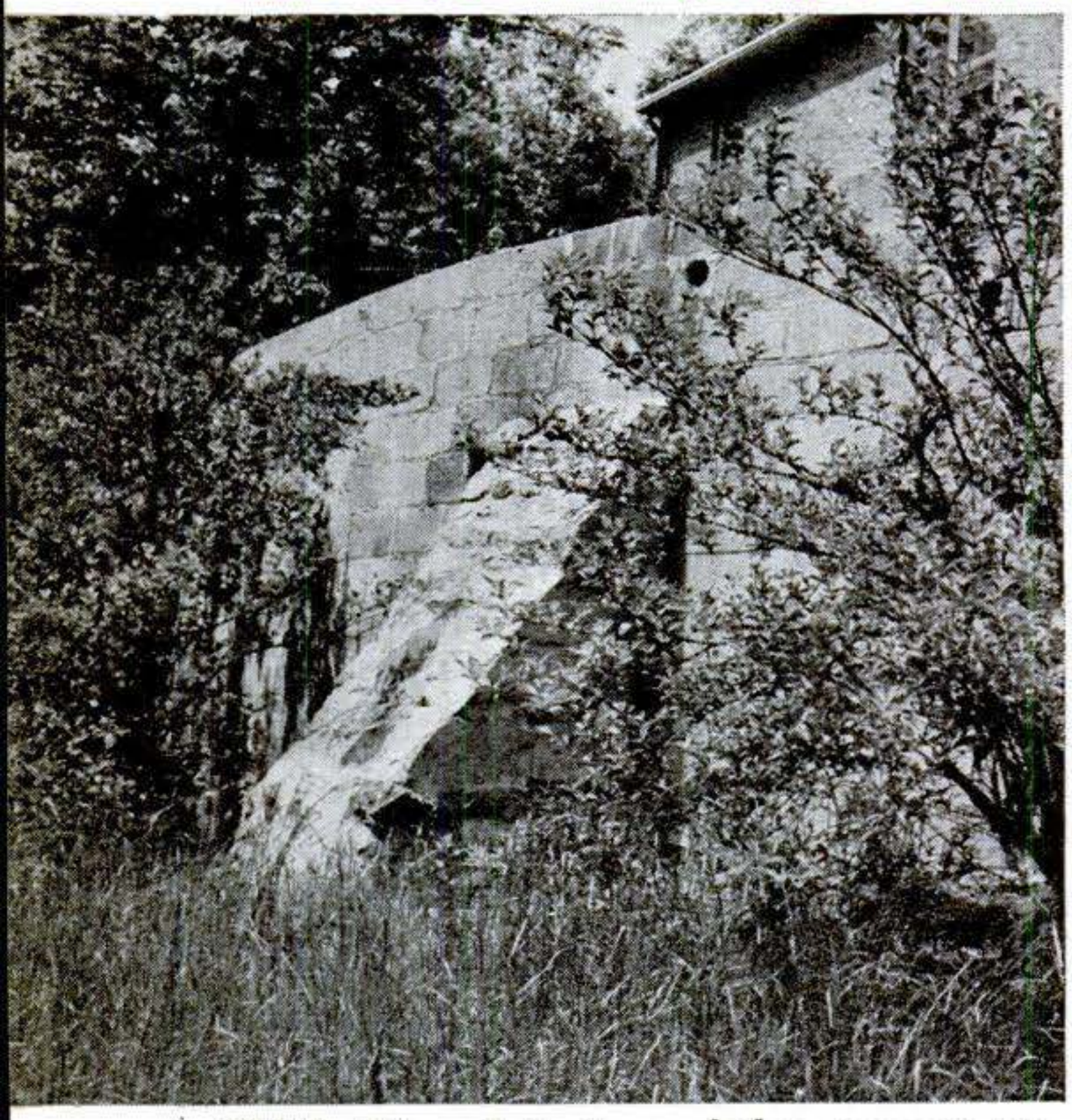


Form for poured wall is made with ½" plywood, braced and staked. Pour footing first, let set, then fill form. Use one part cement, two sand, three gravel, enough water for workable mix.

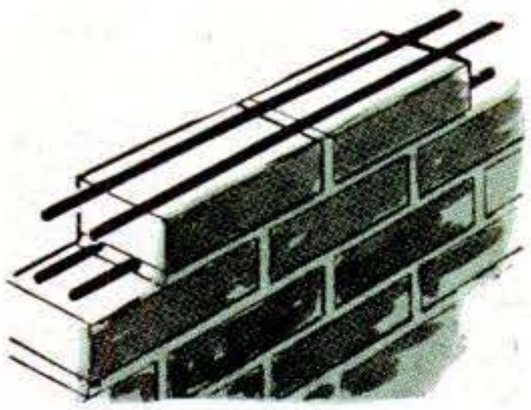


Straight wall gets stability from broad, heavy base, like child's weighted toy that always lands upright. Width at bottom should equal ⅔ height. Inclined wall lies against earth, takes less concrete since base need be only ⅓ height. Cantilever wall is thinnest, takes least concrete, but needs reinforcing rods to tie it to footing that acts as counterweight.

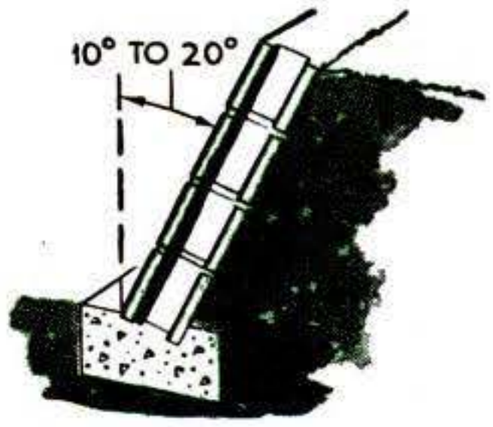
Five ways to help make concrete-block walls stronger



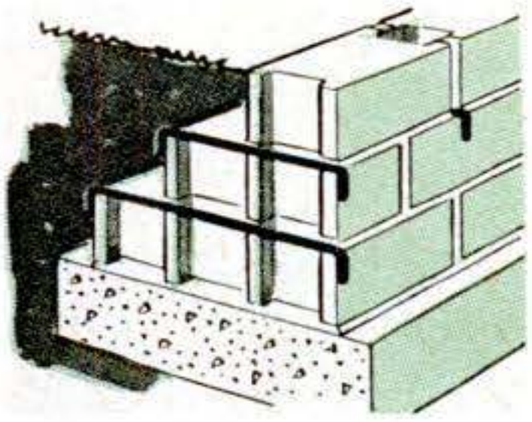
Old-fashioned buttress helps support tremendous load on this 12'-high wall, can be used in smaller versions to brace low walls.



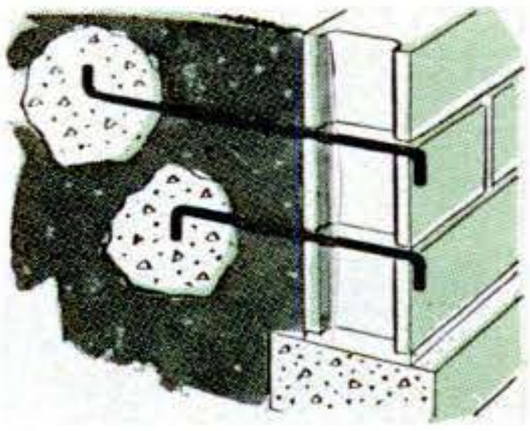
Reinforcing rods, embedded in joints, help tie blocks together so wall acts as single unit.



Inclined blocks are harder to push over. Set bottom row into footing while it's still soft.



Stepped blocks give broad, heavy base like poured wall, but require no forms. Blocks should be joined by rods running front to back.



Concrete anchors, made by pouring cement into pockets in earth, help hold wall. Blobs are tied to wall by rods bent at ends.

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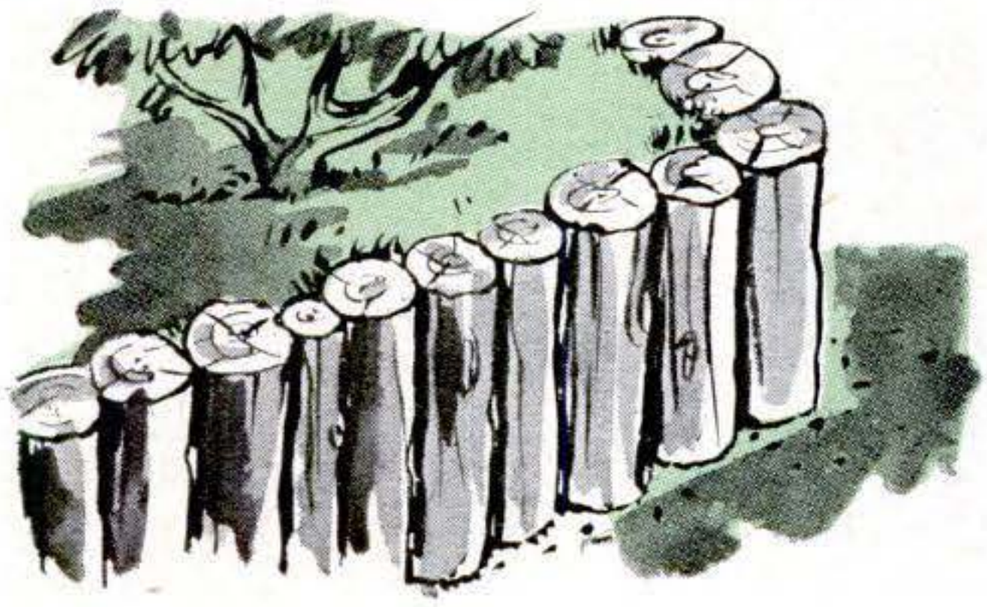
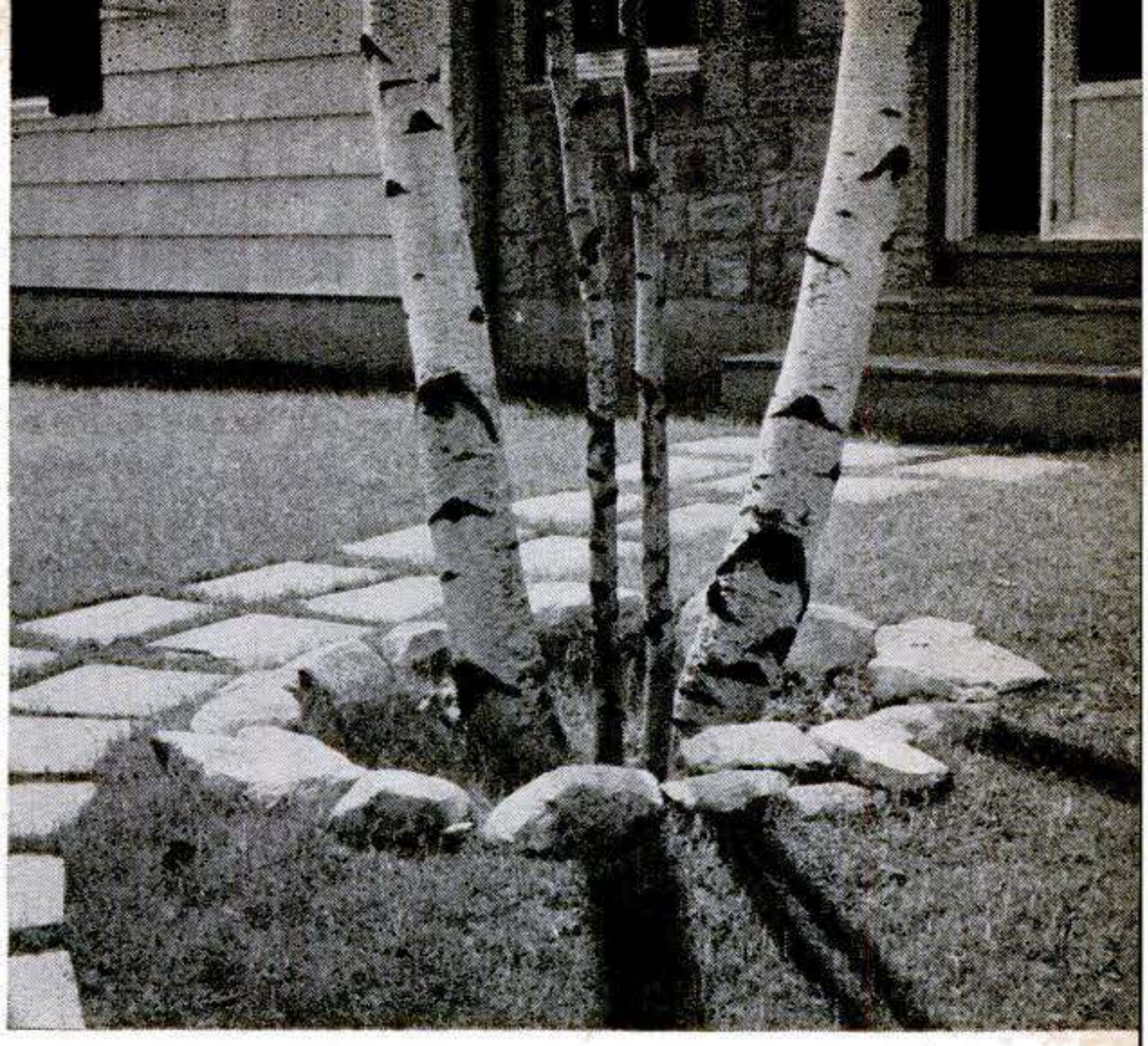
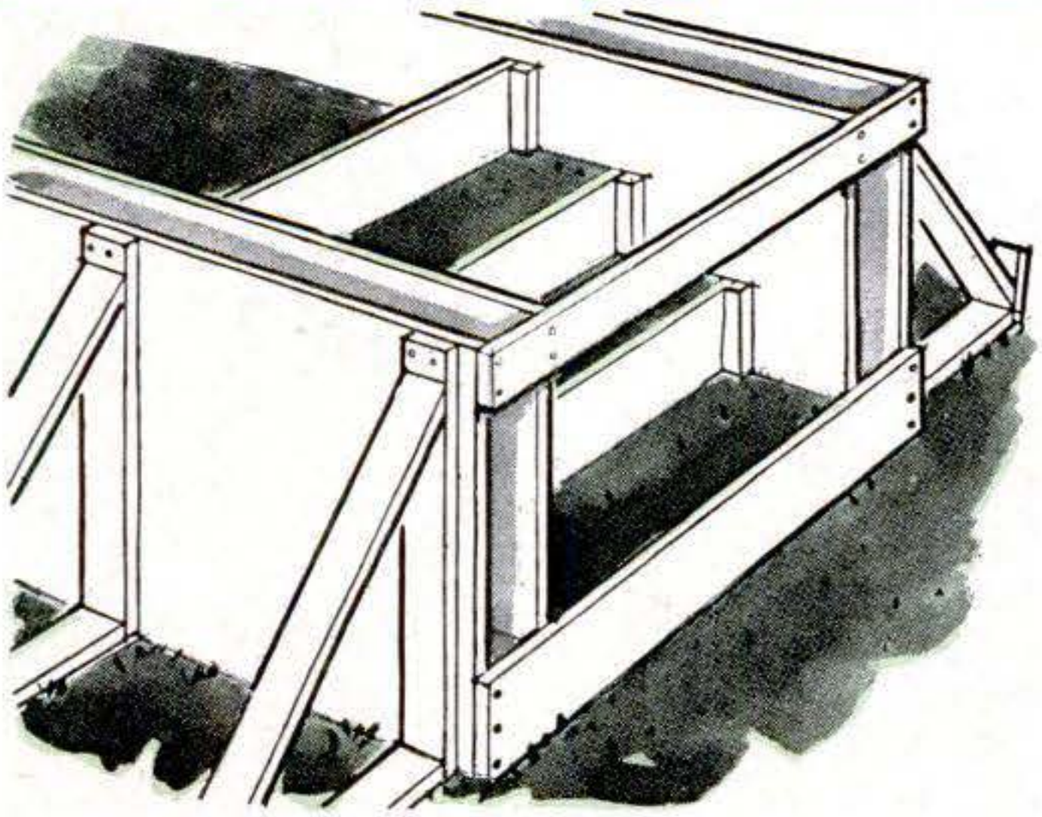
Wells and boxes protect trees

Earth around trees must be kept at original level if you raise or lower grade line. Boxes can be made of wood stakes driven into ground (below), but should be big enough to encompass roots and tightly fitted to prevent loss of water. Wells should be made of loose, uncemented stones (right) so water can seep in.

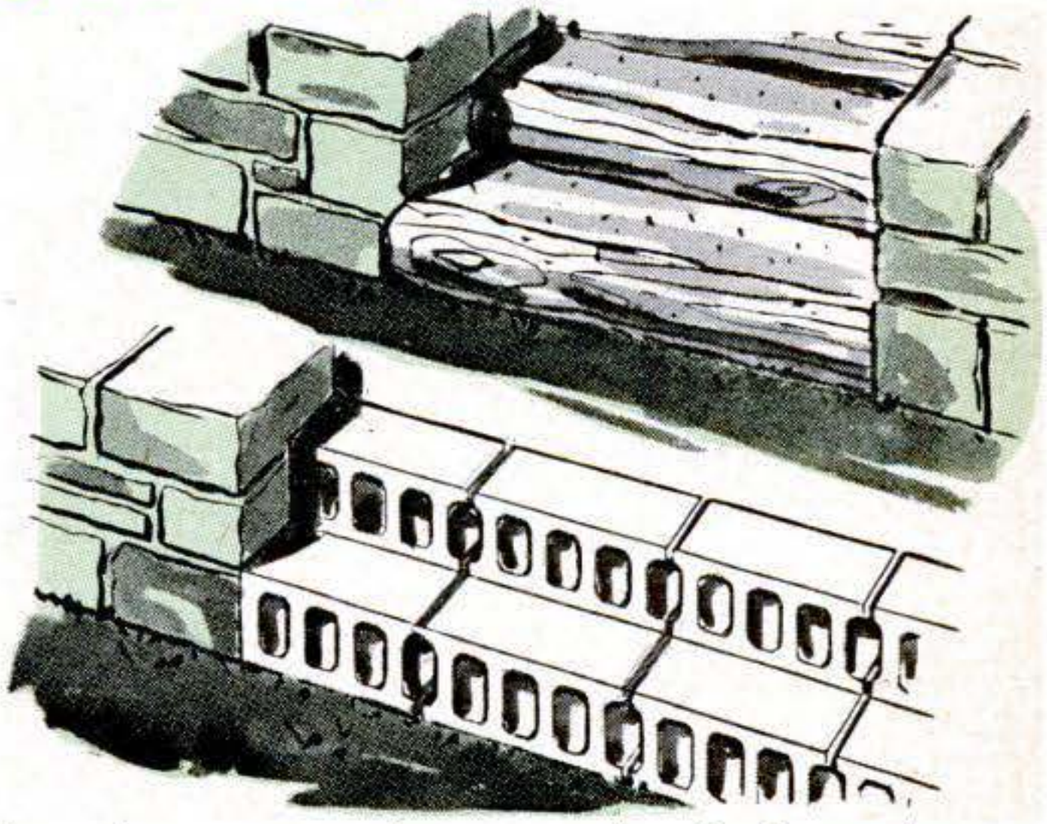




Three kinds of steps you can easily add to any wall

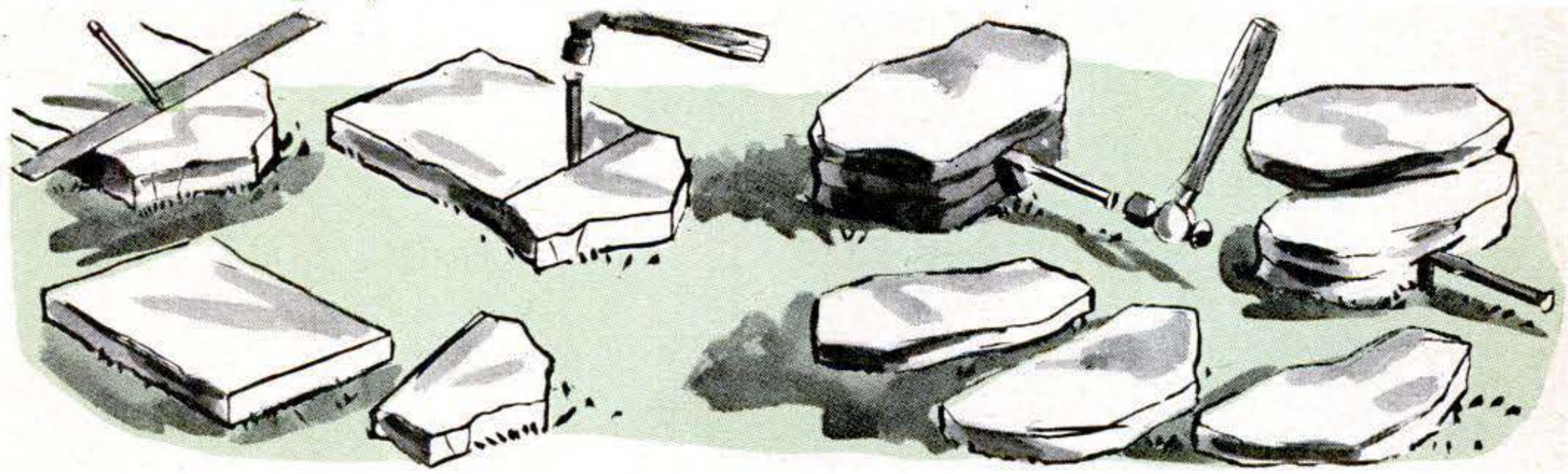


Poured-concrete steps are strongest, can be made by erecting two upright forms of plywood and joining these with cross boards for steps. Pour each step separately and allow to set so that weight won't push cement out bottom.



Log steps are easiest to make, look rustic, go best with wood or rough-stone walls. Concrete blocks turned on side are cheap, stay put well because of weight and provide natural drainage through mortar openings.

You can shape your own rocks with a hammer and chisel



Stones can be trimmed to a straight edge with a hammer and cold chisel. Mark stone first with ruler and soft pencil on all sides, and score lines with chisel to depth of about ⅛" all around. Then use heavier blows, working chisel from center of stone out to sides, and rock should break cleanly.

Flat slabs for steps or walls can be made by splitting large boulders along seams where they have already started to crack. These seams usually look darker and deeper than others, often have moss growing in them. Work cold chisel along seam, using heavy hammer. Gradually deepen crack until rock splits. **END**

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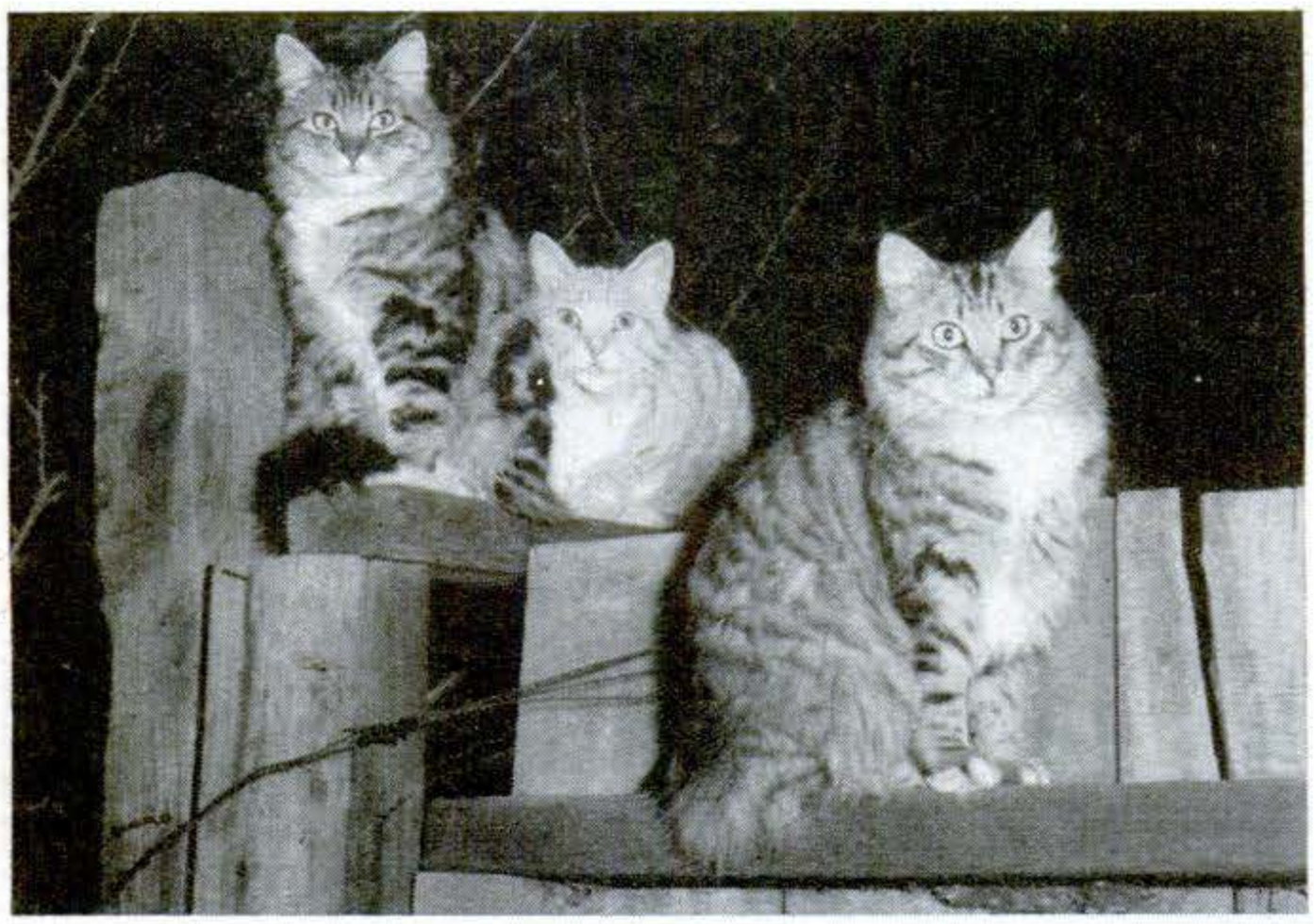
It's Not Cricket

But all photographers who hope to take good pictures should buy and carry a dime-store cheeper. It is a sure way of attracting attention.



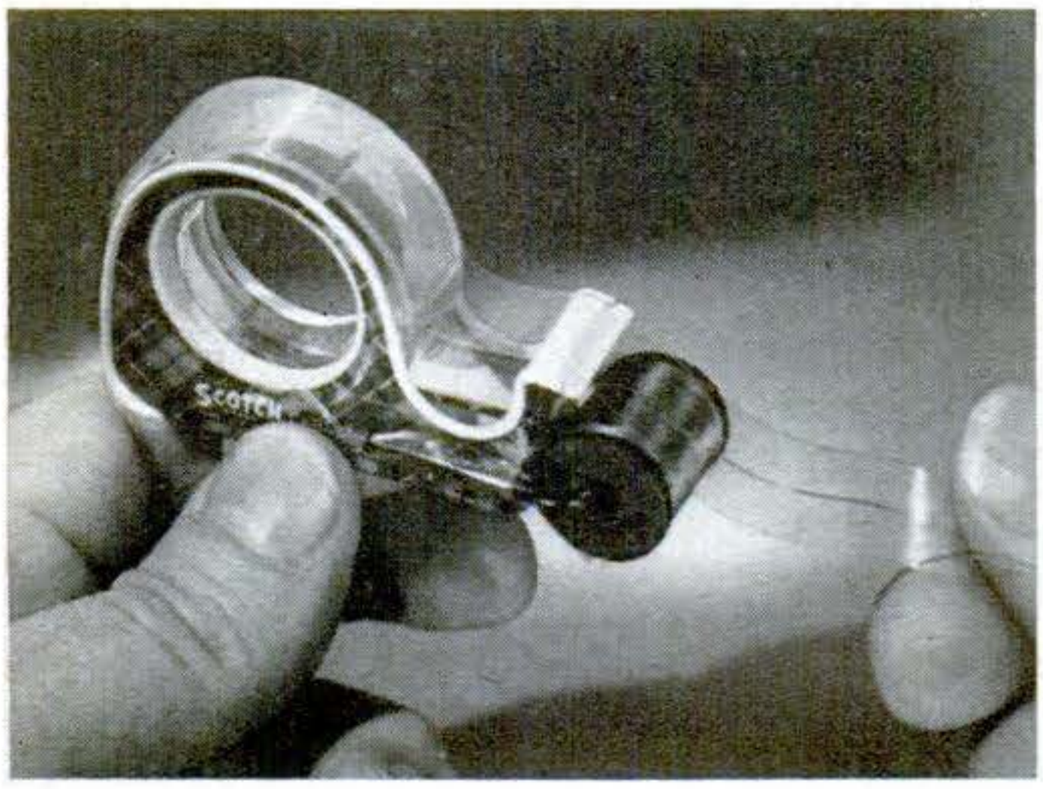
BEARS INVESTIGATING, ANYWAY. The cricket chirped in the back-yard darkness, and every eye of this fence-top trio focused on the source of the sound. Then came the flash.

IT'S JUST A JOKE. Or so this happy guy seemed to think when the metal cricket chirped.

WHEN you photograph pets or very young children, the sharp cheep of a toy cricket will attract and hold their attention.

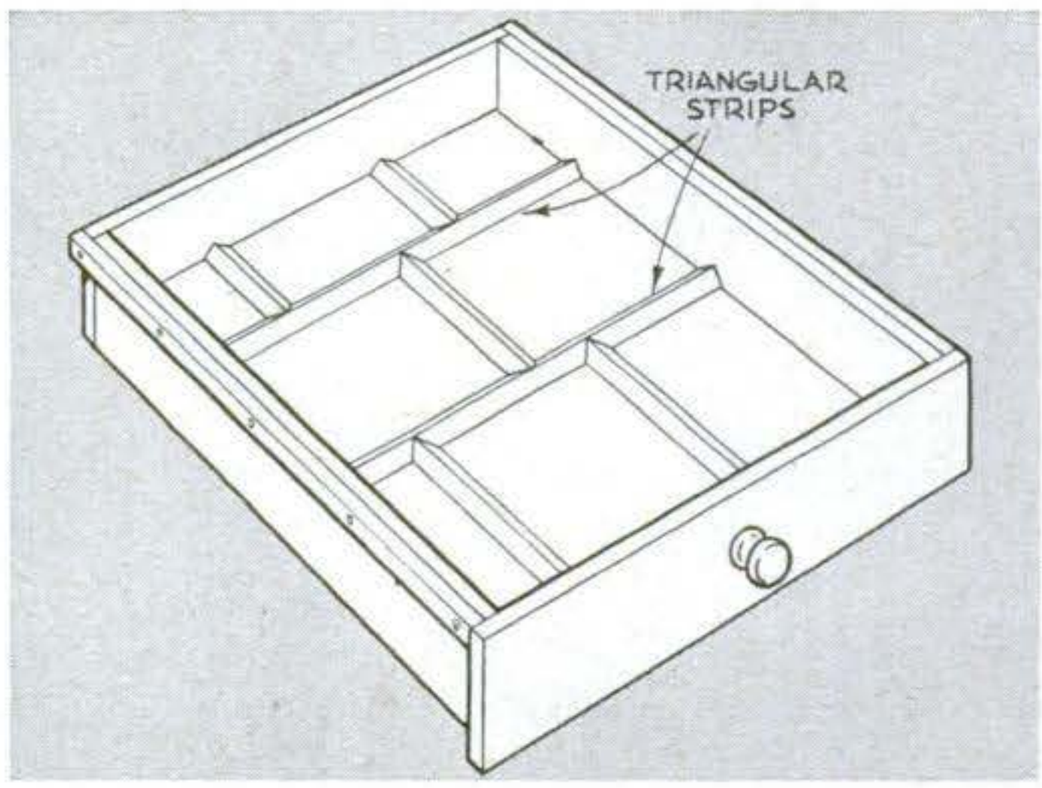
With pets, have everything in readiness for the exposure, click the cricket where you wish the eyes to be looking, and then trip the shutter. With children, the first use of the cricket usually will produce an expression of surprised curiosity. Later the child usually will eye the cricket with anticipation when you hold it forth, and break into a gleeful smile when you press it to squeeze out the cheeps.—*Gilbert C. Close, Hawthorne, Calif.*

Thread Under Tape Zips It Off



IT WILL be easier to open tape-sealed packages if you include a pull thread under the tape. For convenient application of thread and tape together, keep a spool of thread on a wire axle taped onto the dispenser.—*Ken Murray, Colon, Mich.*

Parts Won't Stick in Drawer



PARTITIONS for storing small parts neatly can be made with triangular wood strips nailed or screwed to a drawer bottom. The small parts slide easily up the sloping faces of the strips instead of catching in corners where they're hard to get out.

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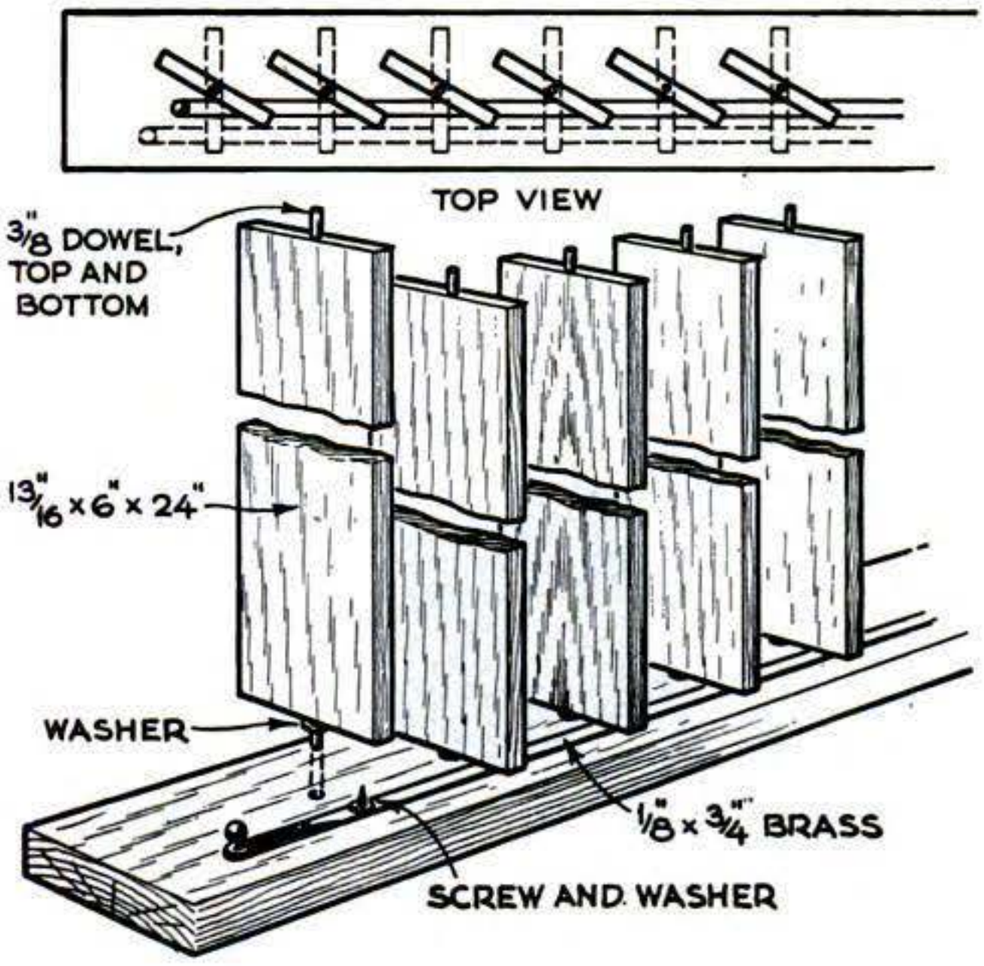
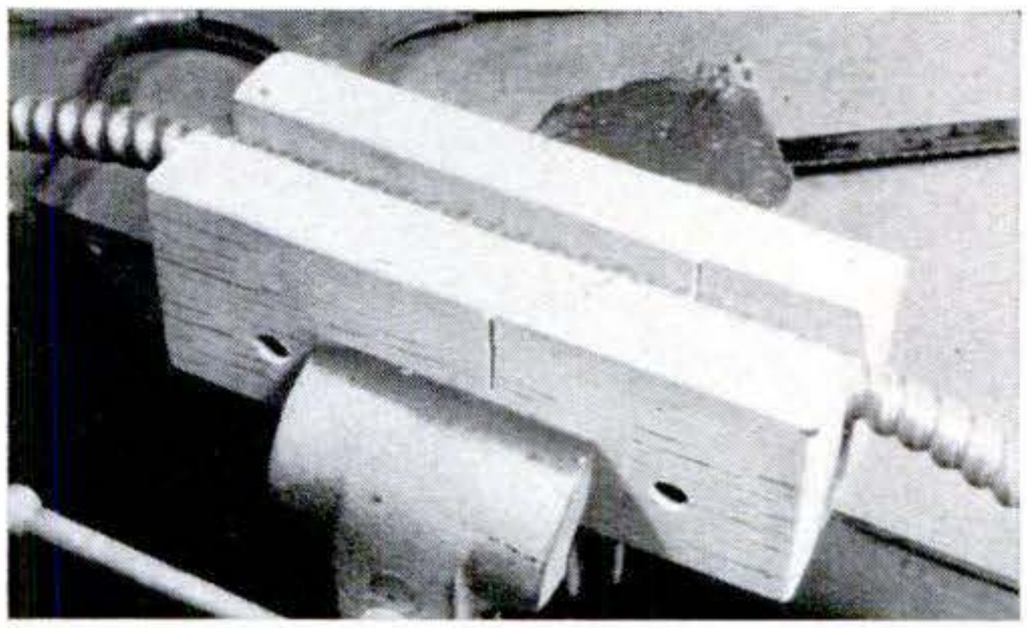
Vertical Louvers Help Decorate Room and Ventilate It, Too



I BUILT these movable vertical louvers to serve as a backdrop for a wall planter and also help ventilate the room. Hardwood to match the wall paneling, the boards are 13/16″ thick and each one is pivoted top and bottom on ⅜″ dowels.

A ⅛″-by-¾″ brass strip with a link arrangement is fastened to one end of the louvers for opening and closing them.—*Hi Sibley, Nuevo, Calif.*

Miter Box Eases Cable Cutting



ARMORED electric cable can be cut a lot faster and easier with a miter box built of wood for the purpose. A spacer of slightly less thickness than the cable is needed between the side pieces. Nail the spacer to one side piece. Fasten the other side to the spacer with roundhead screws in countersunk, oversize holes so it can move about ¼″. Clamp the box closed and carefully make a 45° saw cut through the sides. In use, the cable is placed in the box and the box clamped in a vise. A hacksaw will then cut the cable at the correct angle.—*Will Thomas, Buffalo.*

Sticks Measure Height Quickly

MEASURING long vertical distances is often difficult with a folding rule of flexible tape. Two strips of wood, slid apart to fit in the space and clamped, will do the trick. The clamped strips can then be removed and laid flat for easy measuring.

Foil Catches Paint Drips

A PIECE of aluminum foil held around a paint can by a rubber band will catch drips running down the side, making the can easy to carry from place to place. Fold foil upward against can for re-use.

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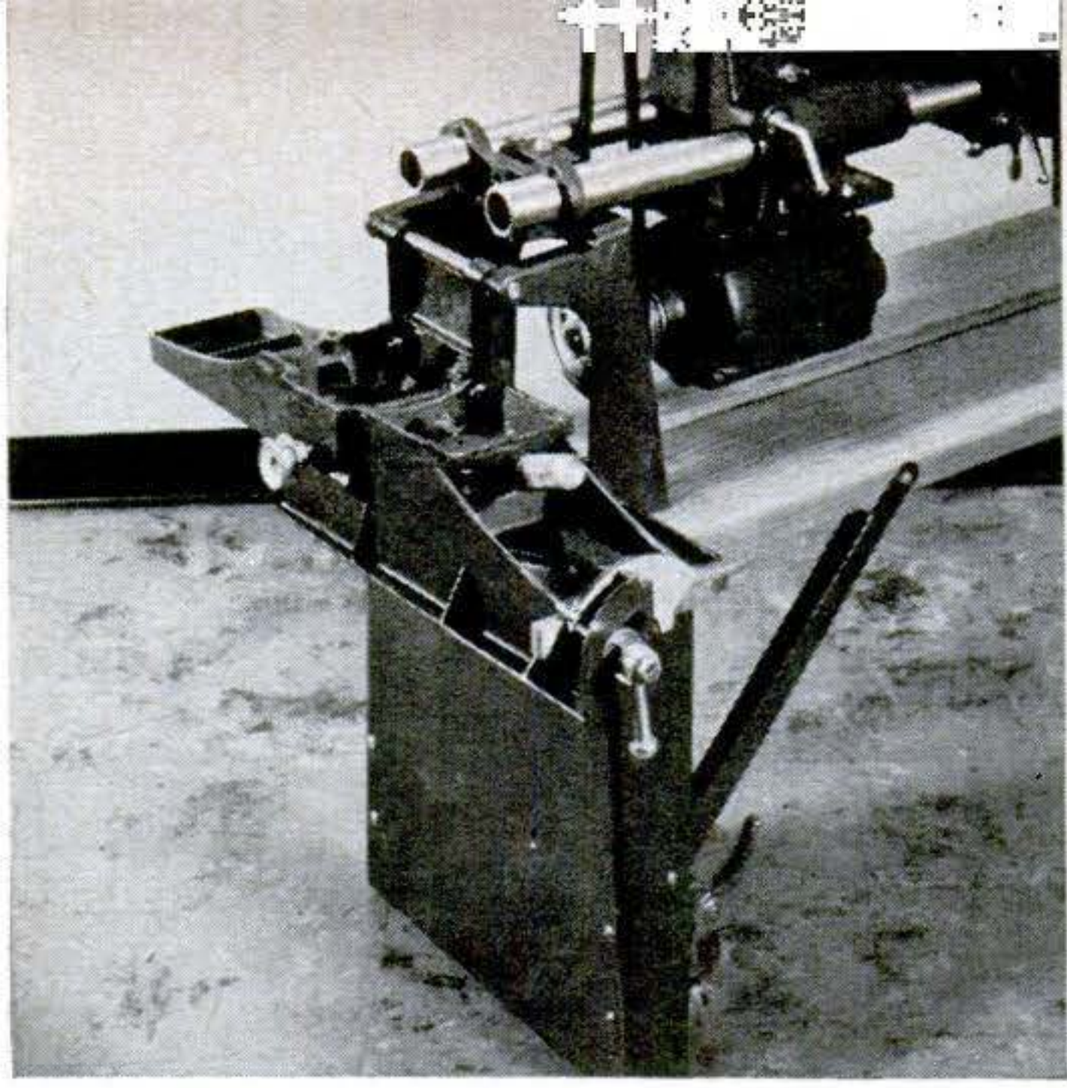
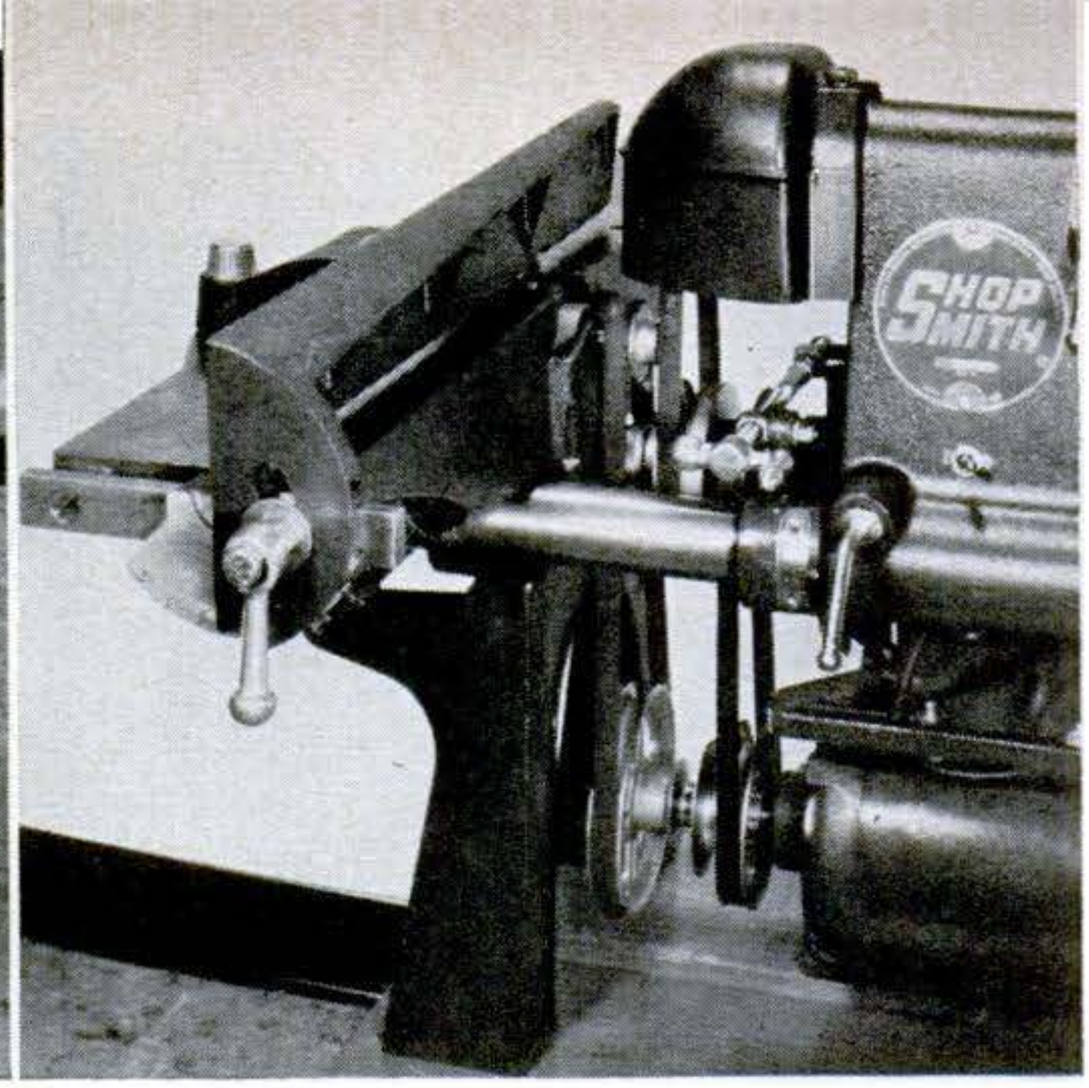




HINGED SUPPORT to swing jointer out of the way is shown at left. Jointer ready for operation, with power supply from belt on speed changer, is demonstrated at right.

Shopsmith adds gadgets

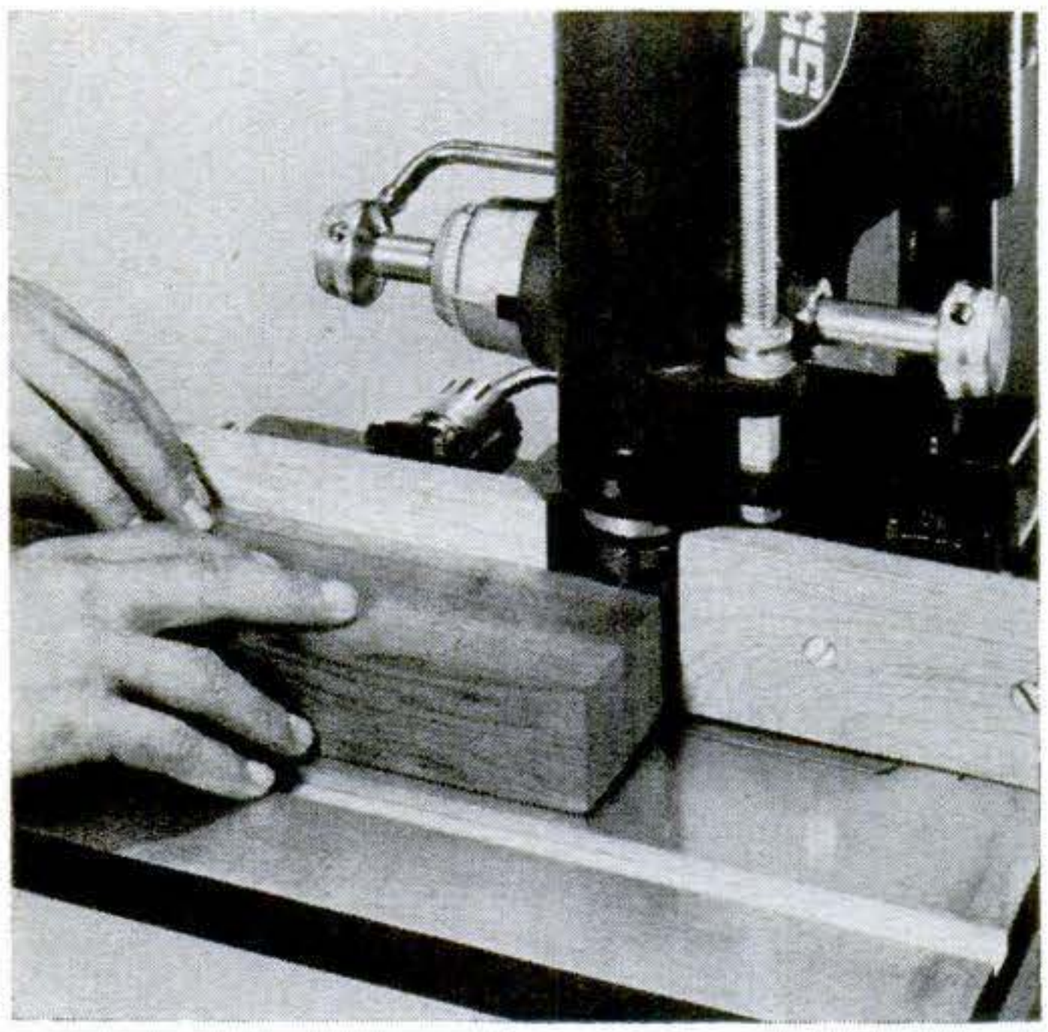
NEW accessories to give the Shopsmith, multipurpose home-workshop tool, more versatility will be placed on the market next month.

Most important of the lot is a jointer, hinged on the support for the left end of the rails that hold the head and motor. Down out of the way when the spindle is being used, it can be swung up easily and locked for use.

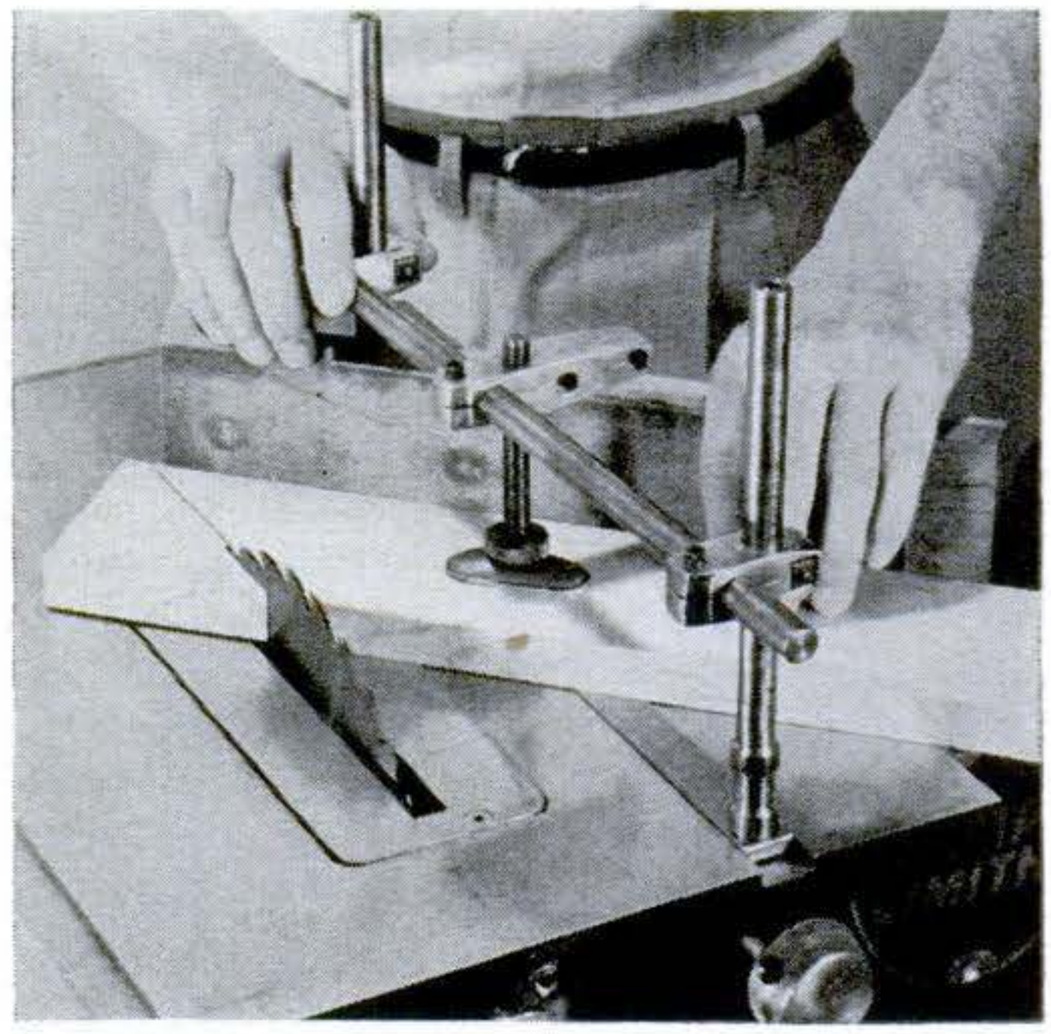
Heretofore, installing the Shopsmith jointer attachment—on the spindle side—was a 15-minute operation.

A second accessory is a shaper fence with a screw adjustment on the infeed side with a knob that clicks every 1/64″ of depth in cut adjustment. A third is a universal hold-down with a wide variety of uses.

Magna Engineering Corp., the manufacturer, this fall will begin corrosion-proofing the Shopsmith to prevent rust in damp atmospheres.



SHAPER-FENCE SPRING INDICATOR for depth of cut is located just under quill feed gauge. Fence locks front and rear on Shopsmith table with cast, U-shaped clamps.



UNIVERSAL HOLD-DOWN can be set up to function on miter gauge, rip fence or shaper fence, or can be clamped to any side of table with Shopsmith vertical or horizontal.

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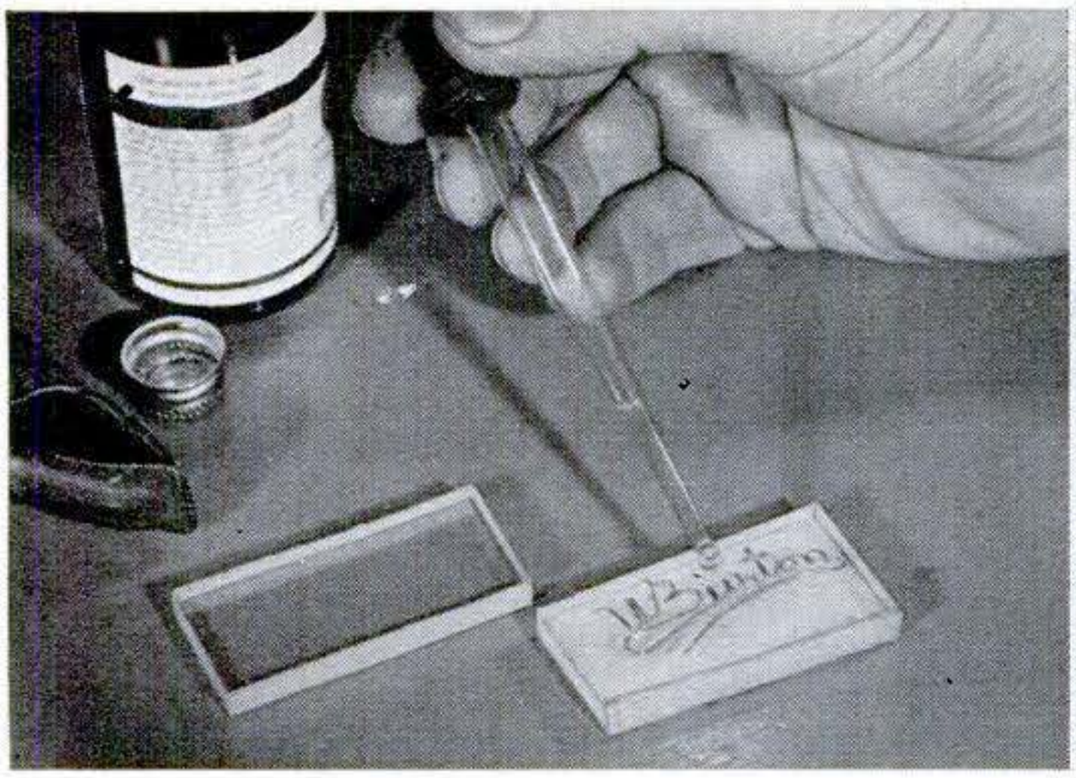
It's Easy to Embed Decorations in Plastic to Make Novelties



HANDSOME plastic novelties are easily made by embedding shaped wire or thin metal objects in a sandwich of clear plastic. Use acrylic (Plexiglas, Lucite) half as thick as the finished piece is to be. Place the wire on one piece, cover it with clear cement or a solvent such as chloroform (*caution, it's inflammable!*) and clamp overnight with the second plastic piece. If decorative object is thick, you may have to soften the plastic by heating it in an oven. After job has hardened, trim plastic to size, polish the edges and drill any holes that are needed. —*Walter E. Burton, Akron.*

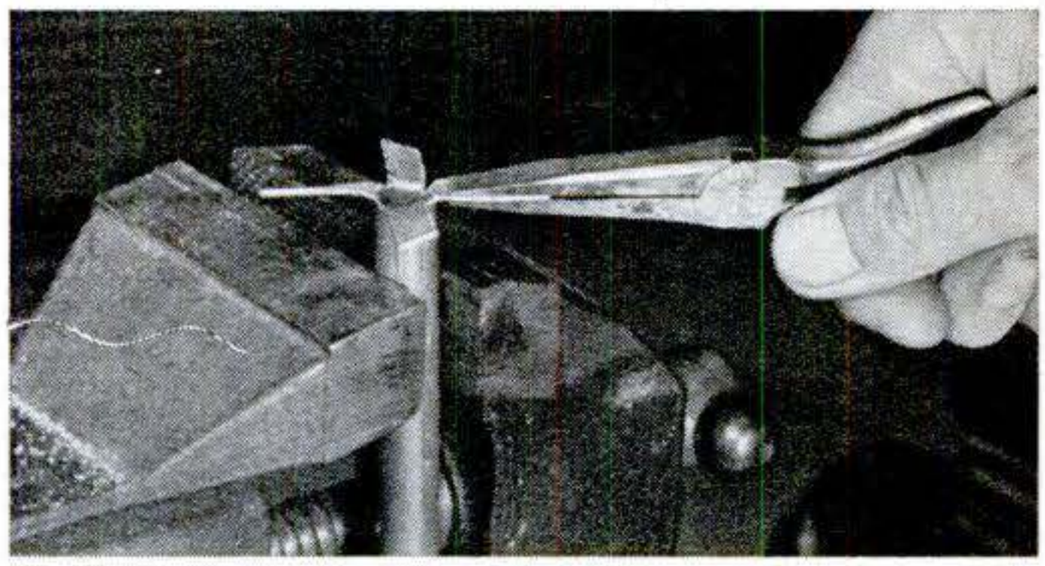
Kit Builds Power Mower

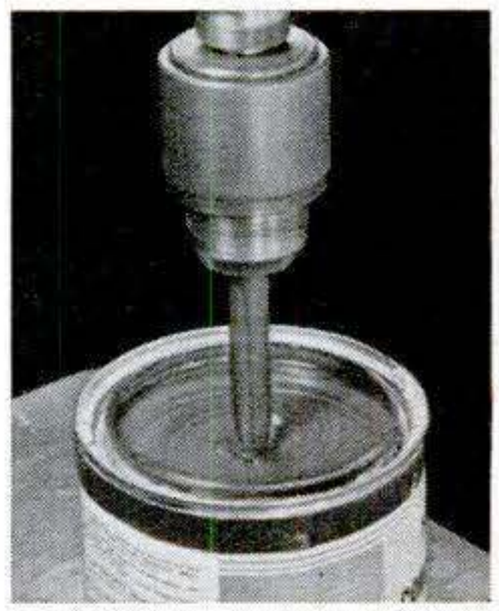
YOU can build this power mower from a kit, add your own secondhand motor, and have a complete rig for about $60. The kit alone costs $46.95, contains all parts, has an 18″ blade and can be powered by any 1½- to 2½-hp. gasoline engine. The simple belt drive makes it easy to adapt different sizes and types of motors. Another model, for use with any ½-hp. electric motor, has a 16″ blade and costs about $25. Both models, made by Sensation Mower, Inc., 7577 Burlington St., Ralston, Nebr., have rubber tires and blade-height adjustments.

Vacuum Cleaner Blows Up Pool

YOU won't waste breath puffing up the kids' plastic pool if you make your wife's tank vacuum do the job. Whittle a hole through a sponge-rubber ball, connect the hole to the pool valve with rubber tubing and stuff the ball in the exhaust end of the cleaner.—*Joel H. Zinsmeister, Hamilton, Ohio.*

Drill Stirs Old Paint Fast





THE quick-and-easy way to stir old cans of paint is with your drill press. An efficient stirring attachment can be made in minutes from thin tubing, one end of which is made into a propeller by hacksawing slots and bending the tabs.

For small cans 7″ is a good shank length; for gallons, about 10″.—*Harry L. Truchelut, Atlanta.*

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These words and pictures will help lick the problem of picking the right roof-rig for your location.

Choosing the Right TV Antenna

IF YOU plan to replace that rickety stork's nest on the chimney with a slick new signal catcher, this chart's for you. It will steer you through the bewildering array of arrays that can be bought, and gives hints on choosing the right rig for your location. Here are some tips on using it:

Db gain. This is electronic lingo for the amount of energy that an antenna will pick up. If you're not an engineer, just remember that roughly speaking the higher the db-gain number the better the antenna.

Band width. This concerns the number of channels an antenna can pick up effectively. In a theoretically perfect antenna, all channels would be received equally well; in practice you lessen the gain from other channels when you design for the most gain from one. An all-channel or broad-band antenna, then, will be a compromise, giving a bit less than the best on each channel.

Directivity. All antennas are directional to some extent, but some are far more so than others. A highly directional job is sometimes valuable in eliminating interference or "ghosts," but unless all the stations you want are in the same direction, you should be able to rotate it.

Distances. The classification of antenna types by distance to transmitter should not be interpreted rigidly. The figures are average for satisfactory reception. In favored locations you'll be able to use a less elaborate antenna, and in difficult spots you may need a fancier array.—*Rudolf F. Graf, NYC.*

Distance to Station UP TO 10 MILES

A

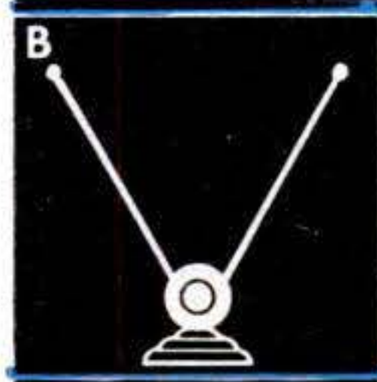
BUILT INTO THE RECEIVER

BUILT-IN

Db gain—0

Usable only where signal is very strong.

B

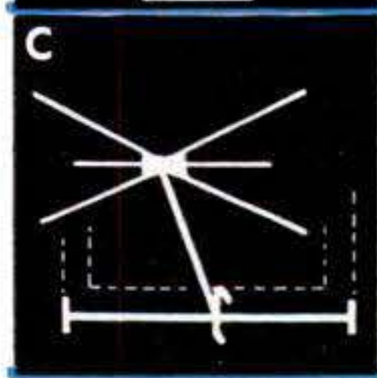


INDOOR

Db gain—0-2

Usually better than A but still useful only close to transmitter.

C

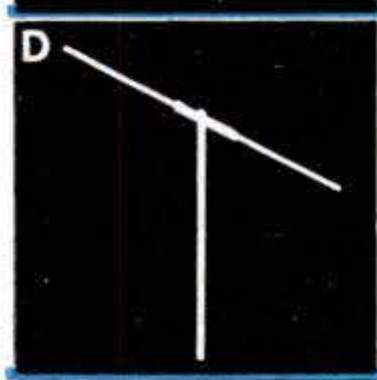


WINDOW

Db gain—3

Moderate gain on all channels. High-frequency stubs help on upper channels.

D

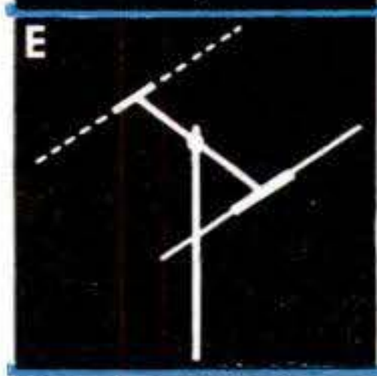


STRAIGHT DIPOLE

Db gain—0

Simplest outdoor antenna for strong-signal areas.

E

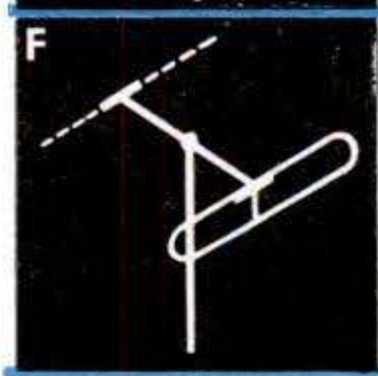


STRAIGHT DIPOLE WITH REFLECTOR

Db gain—5

Addition of reflector increases gain but makes antenna directional.

F

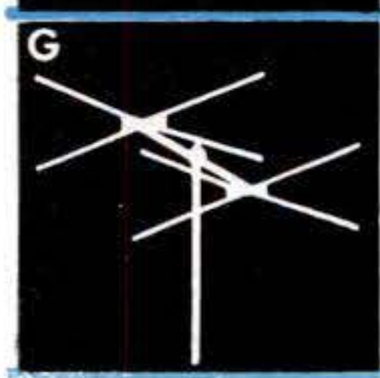


FOLDED DIPOLE WITH REFLECTOR

Db gain—5

Good broad-band antenna. For best results use one for channels 2 to 6, another for 7 to 13. Directional.

G

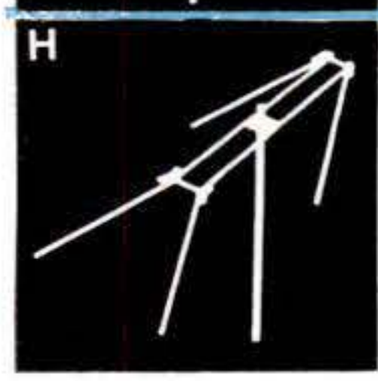


CONICAL

Db gain—5

All-channel antenna. Moderately directional.

H



V-BEAM

Db gain—6½

Broad-band directional antenna with better gain on upper channels. Open end faces toward station.

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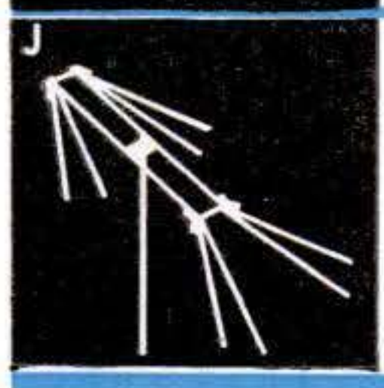
(Antennas E, F, G and H may also serve this area.)

IN-LINE OR STRAIGHT-LINE

Db gain—7

Gives good performance over the entire TV band. Directional.



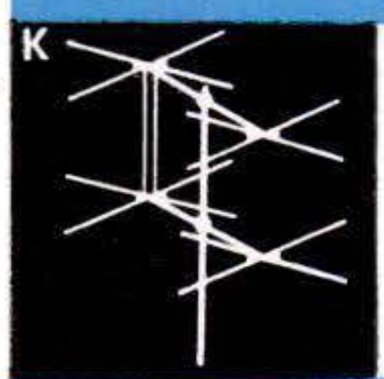
EIGHT-ELEMENT CONICAL V

Db gain—7

High-gain wide-band antenna. Open end faces station. Very directional.

Distance to Station UP TO 25 MILES

(Antennas I and J may also serve this area.)



STACKED CONICAL

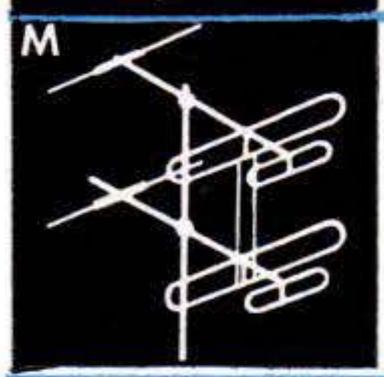
Db gain—6½-7½

High gain over entire TV band.

STACKED FOUR-ELEMENT V-BEAM

Db gain—8

High gain, directional, favors upper channels.



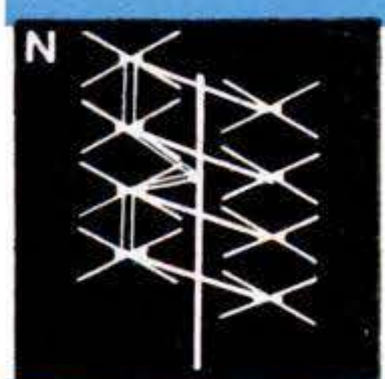
STACKED IN-LINE OR STRAIGHT-LINE

Db gain—8½-9

One of the simpler high-gain directional antenna assemblies.

Distance to Station UP TO 50 MILES

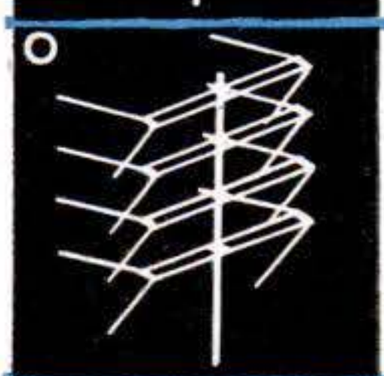
(Antennas L and M may also serve this area.)



FOUR-BAY DOUBLE-STACKED CONICAL (FOUR FRONT ELEMENTS)

Db gain—7-8

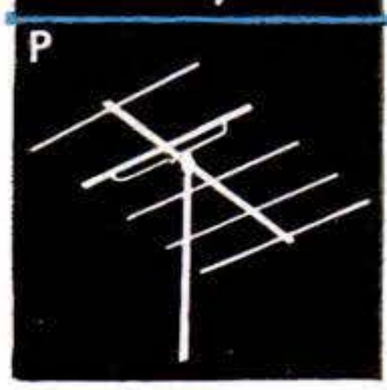
Good high-gain, broad-band, directional antenna. Quite large and heavy.



FOUR-BAY DOUBLE-STACKED FOUR-ELEMENT V-BEAM

Db gain—9-9½

High gain over entire TV band. Favors upper channels. Very directional.

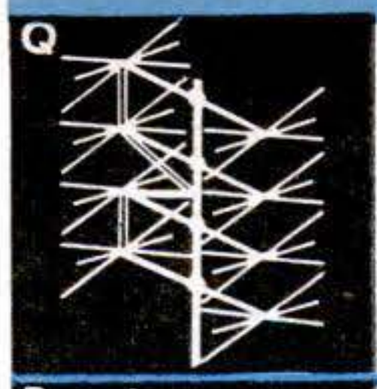


FIVE-ELEMENT YAGI

Db gain—9

Very directional. Each antenna good for only one channel.

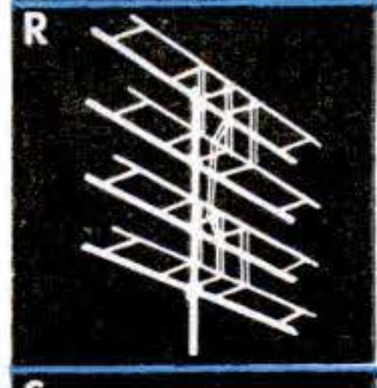
(Antennas O and P may also serve this area.)



FOUR-BAY DOUBLE-STACKED CONICAL (SIX FRONT ELEMENTS)

Db gain—8-9

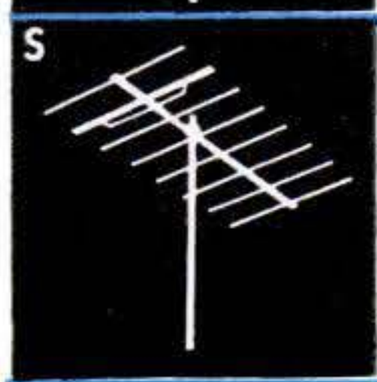
High-gain, broad-band, directional ant
Quite large and heavy.



COLINEAR ARRAY

Db gain—10

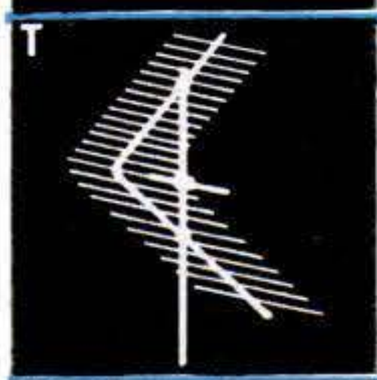
High gain on all channels, including certain UHF channels. Directional.



EIGHT-ELEMENT YAGI

Db gain—11

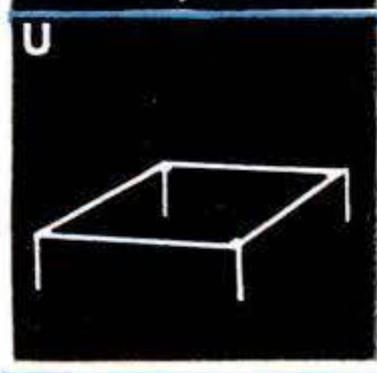
Sharply directional. Covers only one channel effectively.



CORNER REFLECTOR

Db gain—11½

Ordinarily used on upper channels only, since low-channel elements are extremely large. Very directional.



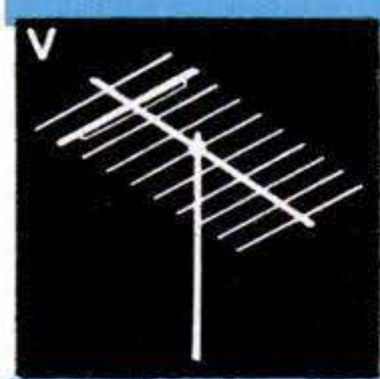
RHOMBIC

Db gain—12

The longer the better. 100 feet on a side is not unusual. Requires plenty of ground space. Very effective, very directional.

Distance to Station UP TO 85 MILES

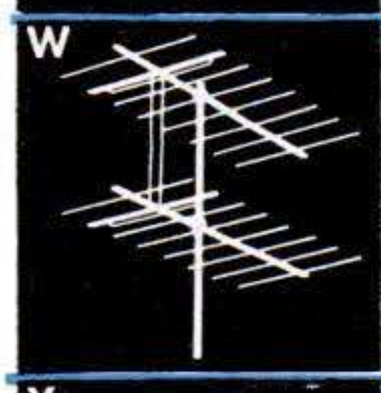
(Antennas T and U may also serve this area.)



10-ELEMENT YAGI

Db gain—12½

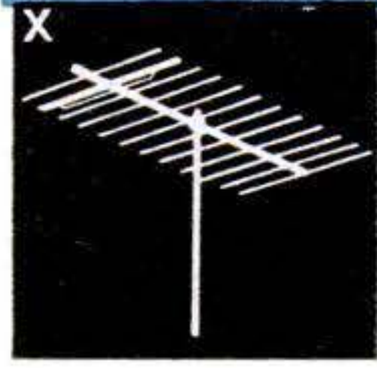
Sharply directional. High gain. Covers only one channel.



STACKED EIGHT-ELEMENT YAGI

Db gain—13

Sharply directional. Usually covers only one channel.



12-ELEMENT YAGI

Db gain—14

Largest commercially available antenna. Quite cumbersome for lower channels. Good for only one channel.

OVER 85 MILES you'll need a bit of luck and some cooperative cloud formations to bounce the signal back to earth and your antenna.

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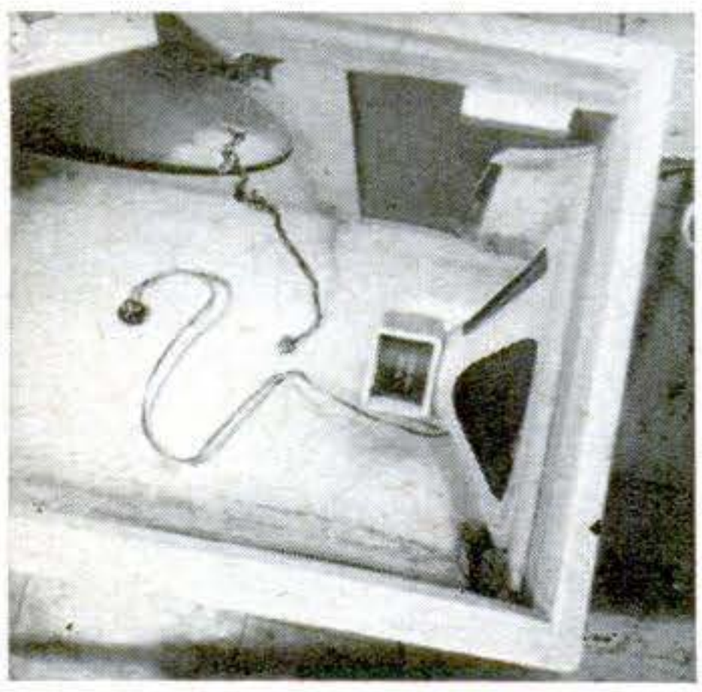
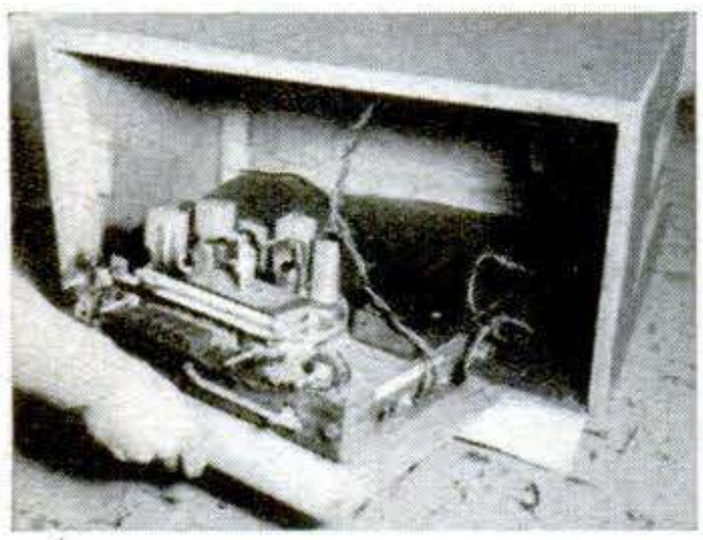
Chairside Cabinet Now Hides My Radio

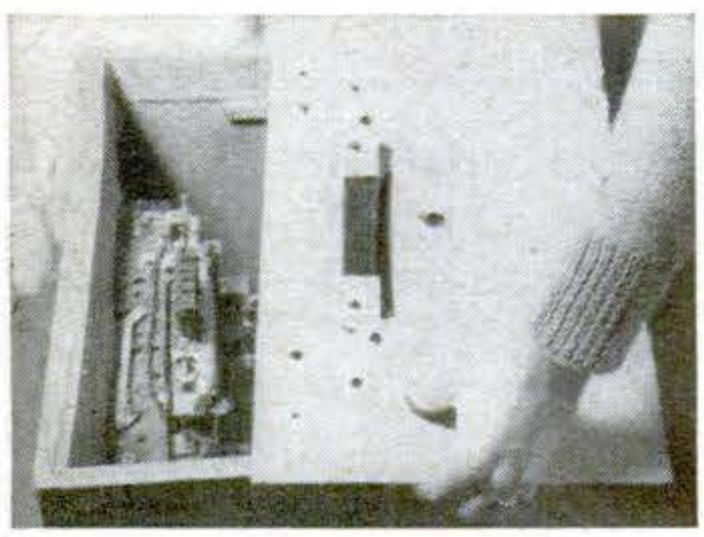
You don't have to be an expert to shift an old set from an outmoded box to a smart, modern cabinet.



SPEAKER is screwed over hole cut in cabinet end. Loop antenna was tacked on side.



ATTACH CHASSIS to ¼" plywood for easier mounting. Then screw it to box.



PLYWOOD PANEL is covered with artificial leather, too. It rests on blocks on sides.

TRIM and up-to-date in appearance, my homemade radio cabinet serves as an end table, too. A hinged lid keeps out dust, opens for tuning. Artificial leather glued on the plywood top and sides hides my slips with saw and hammer.

Housing the works from an outmoded set in a chairside model like this is a worthwhile project for anyone. It gives you a handsome piece of furniture in place of a monstrosity. And locating the radio beside a chair saves many steps.

My cabinet consists of six pieces of ¾" plywood. However, thinner and less expensive material might be used. The two sides are 19" by 27", the ends 14" by 19", and the top and bottom 14" by 27". The panel was made from ¼" plywood.

An opening was cut in one endpiece for the speaker. I shaped the opening as an H, my initial. You may want to do something of this sort, or perhaps cut a circle and glue ¼" dowels across it. After the opening had been covered inside with cloth, I attached the speaker with screws.

To form the lid, I sawed a 7"-by-18" section from one corner of the top and attached it with a strip of piano hinge. A coping saw was used to cut holes in the ¼" plywood panel for the knobs and dial.

Ends and sides of the cabinet were nailed and glued. When the radio had been mounted, I attached the cabinet bottom with screws. Finishing nails hold the top. Driven in with a nailset, the heads of these disappeared in the leather. *—Darrell Huff, Sonoma, Calif.*

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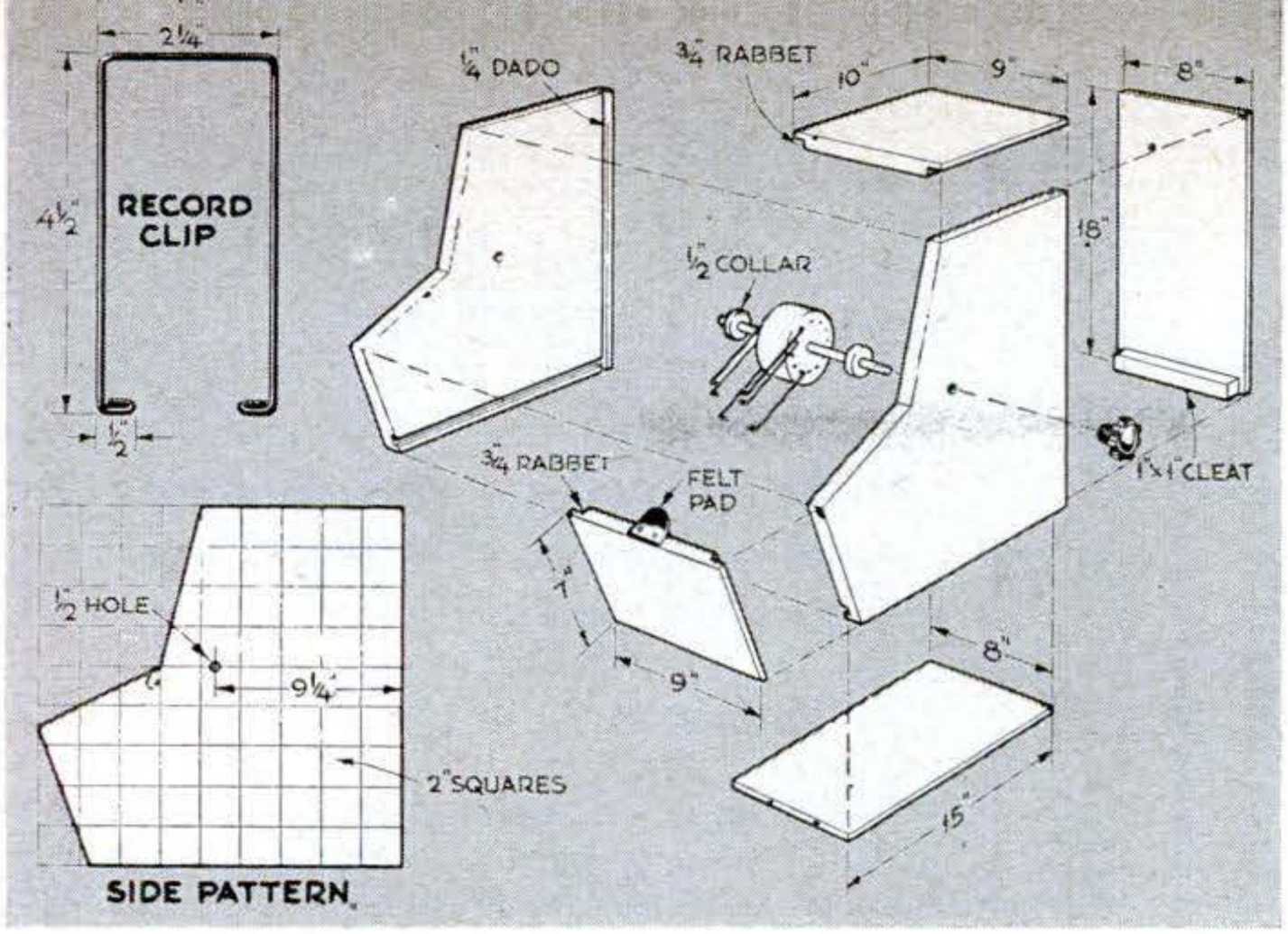


Records Flip Over in This Cabinet for Easy Selection

SLOWLY twisting the knob on the side of this cabinet brings both sides of 45-r.p.m. records into view. About 25 of these records can be stored in the cabinet. The records flop over like pages of a book, coming to rest on the felt pad, then dropping down into the cabinet as the next record swings out from above.

The 4"-diameter hub is cut from a piece of two-by-four. A radio or rheostat knob turns the ½" dowel on which the hub revolves. Two ½" collars keep the dowel centered in the cabinet. The clips are formed from wire clothes hangers.

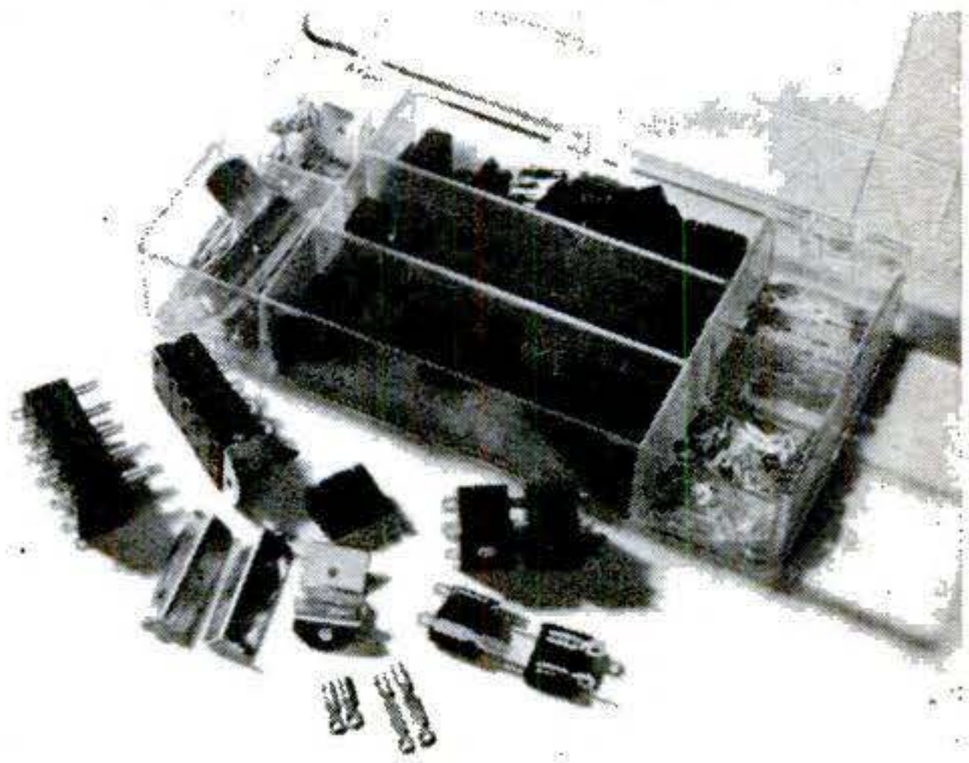
The cabinet parts are all cut from ¾" plywood except the back and bottom, which are ¼" thick and fit into dadoes cut in the sides. *—Larry E. Fannon, Los Angeles.*

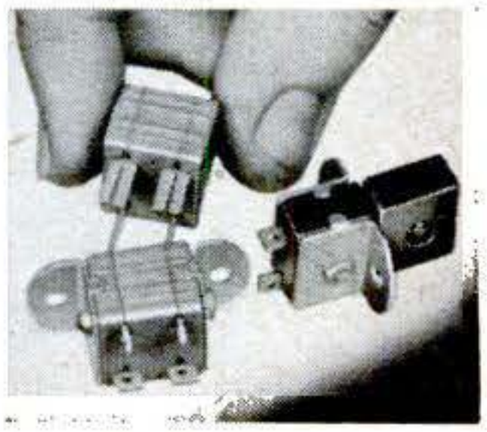
Hi-Fi System Has Two Speakers

Two matched 10" speakers providing wide-range distribution of music and sound are featured in a new portable high-fidelity sound system called the Rhythmaster.

A variable-speed turntable plays records from 6" to 16" at normal speeds of 33⅓, 45 and 78 r.p.m., as well as any variation of speed from 25 to 100 r.p.m. without distortion. *Rek-O-Kut Co., 38-01 Queens Blvd., Long Island City, N. Y.*

Connectors Made with Kit Parts





THE electronic experimenter, model railroader or radio builder can assemble multiple connectors with any number of contacts using combinations of four basic parts contained in this kit. Called Varicons, the contacts can be put together in a variety of arrangements to polarize the connections. Side brackets hold the parts together after assembly. *Elco Corp., 190 W. Glenwood Ave., Philadelphia.*

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You Run This Tractor

Midget battery-powered "cat" works on special frequency requiring no ham license.

By Howard G. McEntee

JUST start up this midget caterpillar tractor and you'll stop everything else in the neighborhood. Kids will quit baseball and fathers will drop their lawn mowers to watch it go.

From anywhere within 100 feet, you drive it—by radio—as if you were behind the wheel. Steer it around obstacles, stop it, reverse it, slew it around on a dime or park it in its own length. Responsive as a sports car, it's as powerful for its size as the real thing. What it can't dodge it will often climb in true "cat" fashion.

Radio control made easy. Been wanting to get started in radio control? Here's your chance. Operating on a special 27¼-megacycle spot set aside for this use, you needn't know code or take an operator's exam. As for radio know-how, most of it is packaged in the transmitter and receiver kits you buy.

These two kits cost about $34, tubes and batteries extra,* but they offer the advantages of simple assembly and clear instructions. Your transmitting license is obtained by mailing a form enclosed with them.

Less vulnerable than a plane or boat, the tractor is an ideal model with which to try your radio-control wings. It won't crash, run away or get lost if you fumble or the system fails. Besides, you can run it indoors.

Toy tractor converted. A husky sandbox toy 12″ long provided a realistic body, wheels and tracks for the model.

For electric drive, the front wheels spin freely on pieces of brass tubing mounted on a fixed steel shaft. Other pieces of tubing space the shaft in the frame, and it is retained with nuts at both ends. The body and frame holes it passes through were enlarged to ½″-long slots, which make it possible to adjust track tension.

Each rear wheel is soldered to a live axle made of ¼″ tubing. Both axles turn in steel

**Berkeley Model Supply, West Hempstead, N. Y.*

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by Radio

bearings soldered to the body and track frames, and are aligned by a fixed shaft through them. Gears soldered to the axles drive them from separate motors, geared down about 800 to 1.

An HO-gauge locomotive worm and gear give a reduction of 29 to 1, the next two gears about 4½ to 1, and the final pair more than 6 to 1. Any similar combination of gears can be used.

Each worm gear and its intermediate gear are soldered together on a bushing and spin on a stud. The middle pair are similarly mounted. All stud holes are oversize so that gear mesh can be adjusted.

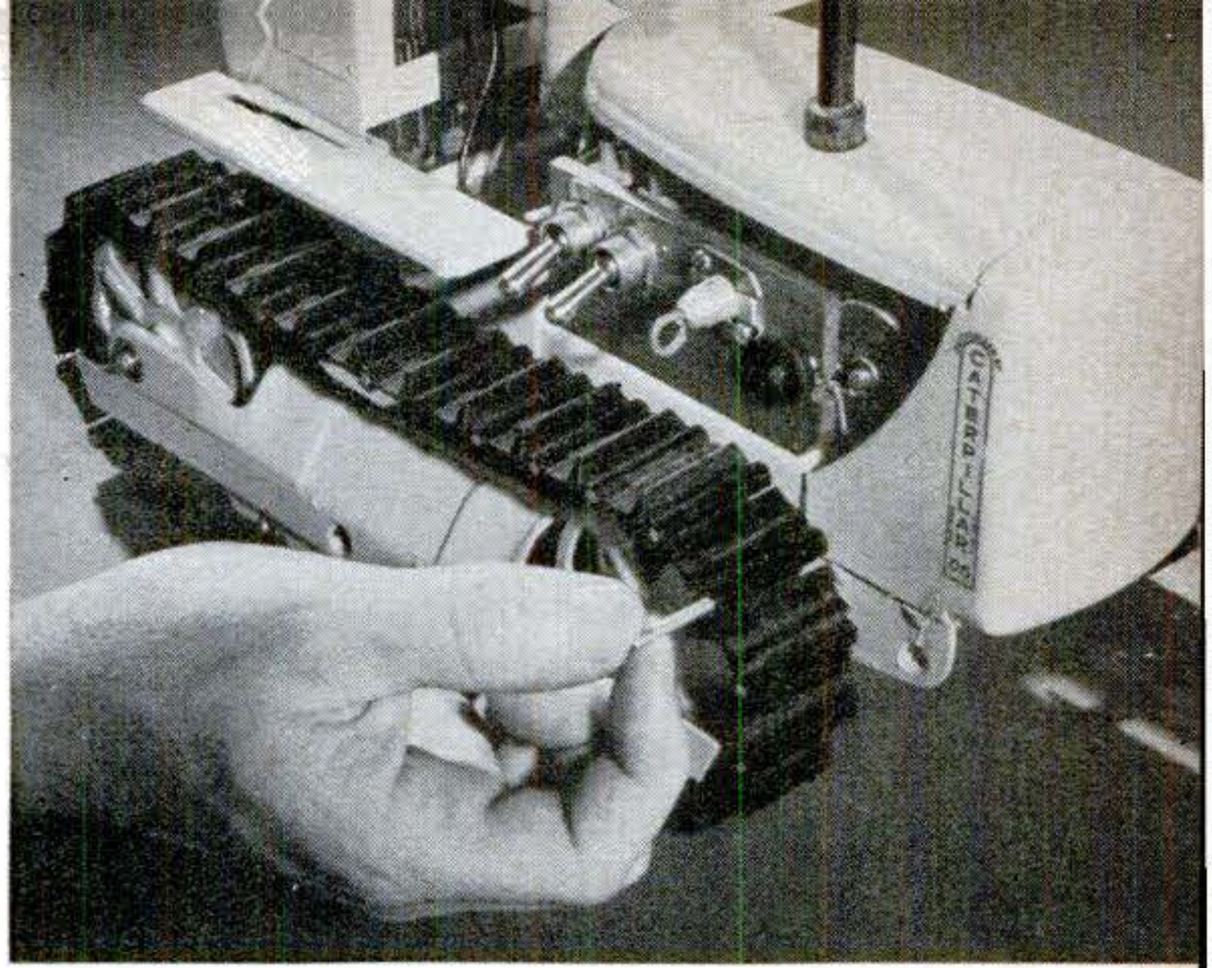
Track rollers added. Five plastic rollers mounted in each track frame project 3/16″ below it. To drive the tracks more positively, a rubber tire was fitted to each rear wheel. The mounting rim consists of a 2¼″-diameter wood disk with a ¾″ center hole, sawed across the diameter, sanded to a snug fit inside the wheel, and cemented in place. The wheel was spun on an arbor and the groove turned. The rubber-tubing tire, cemented into the groove, is scored to grip the tracks better.

Wipe excess lubricant off the tracks before installing them. Adjust the front wheels so that the top of each track can be lifted ⅜″ with light pressure.

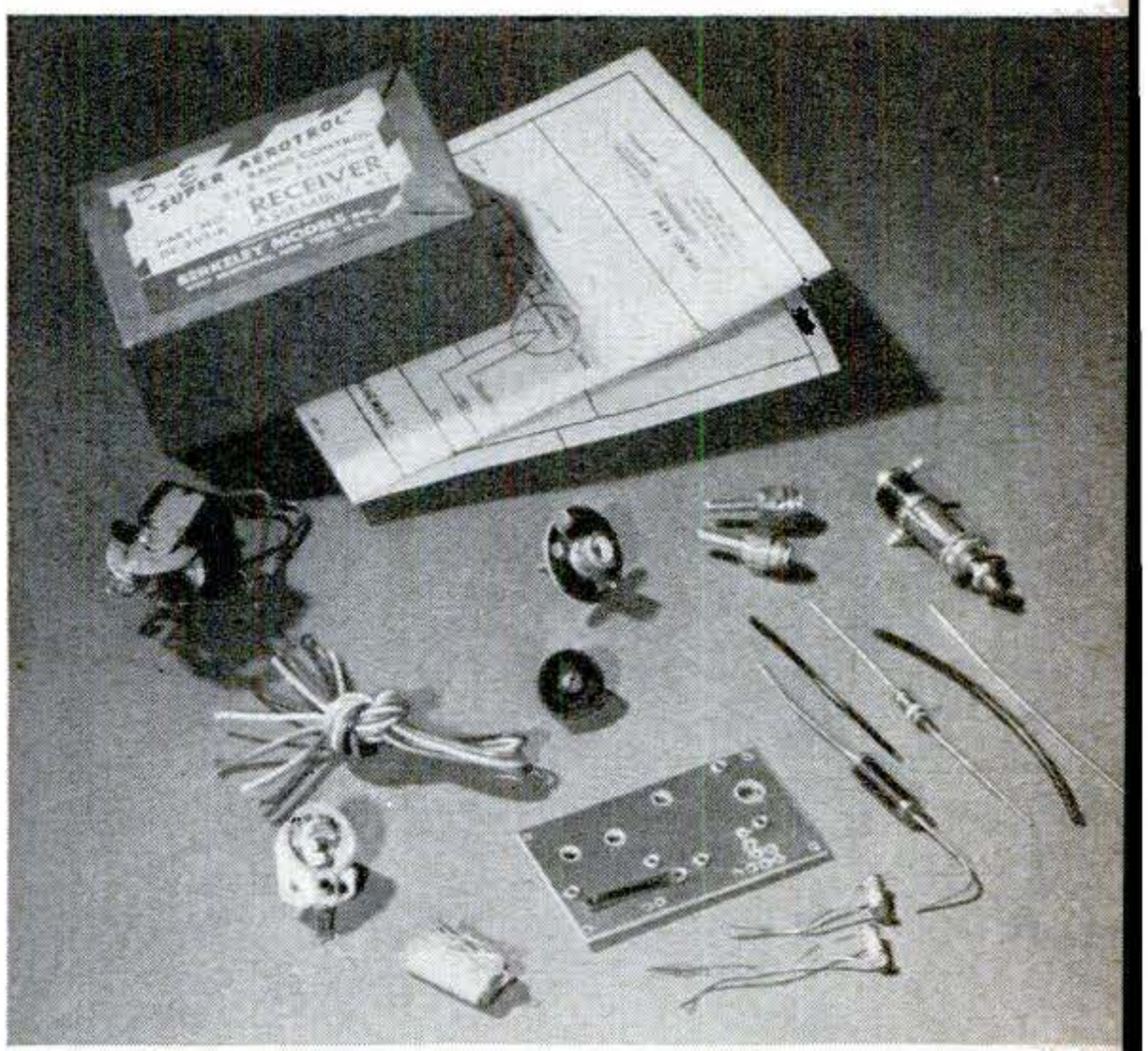
Choosing the motors. These are permanent-magnet battery motors with bronze bushings and heavy-duty brushes. Pick two that rev up to about the same speed as indicated by pitch; if one tread runs ahead of the other, you may have to put an adjustable resistor in its circuit.

My motor shafts proved a bit too big for the worms. By running the motors on three volts and holding a fine file on the shafts, I dressed them down enough to fit. A light tap seated the worms for keeps.

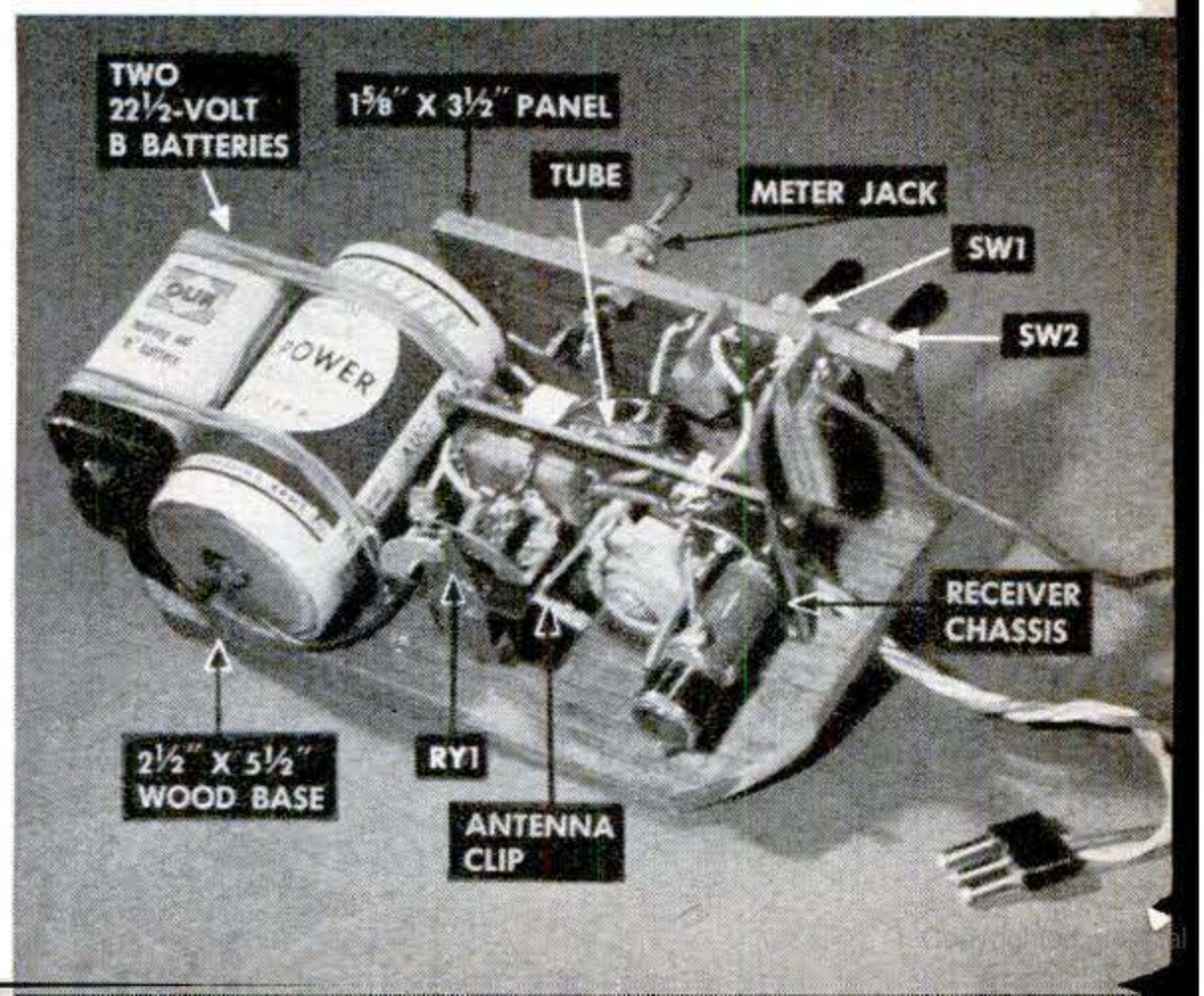
How the controls work. A cat is steered by slowing one track and letting the other run, so your radio control must allow you to run either motor without the other. It's also nice to be able to start, stop and reverse both motors simultaneously. But all the transmitter can do is send a signal or not. How to wangle all these choices out

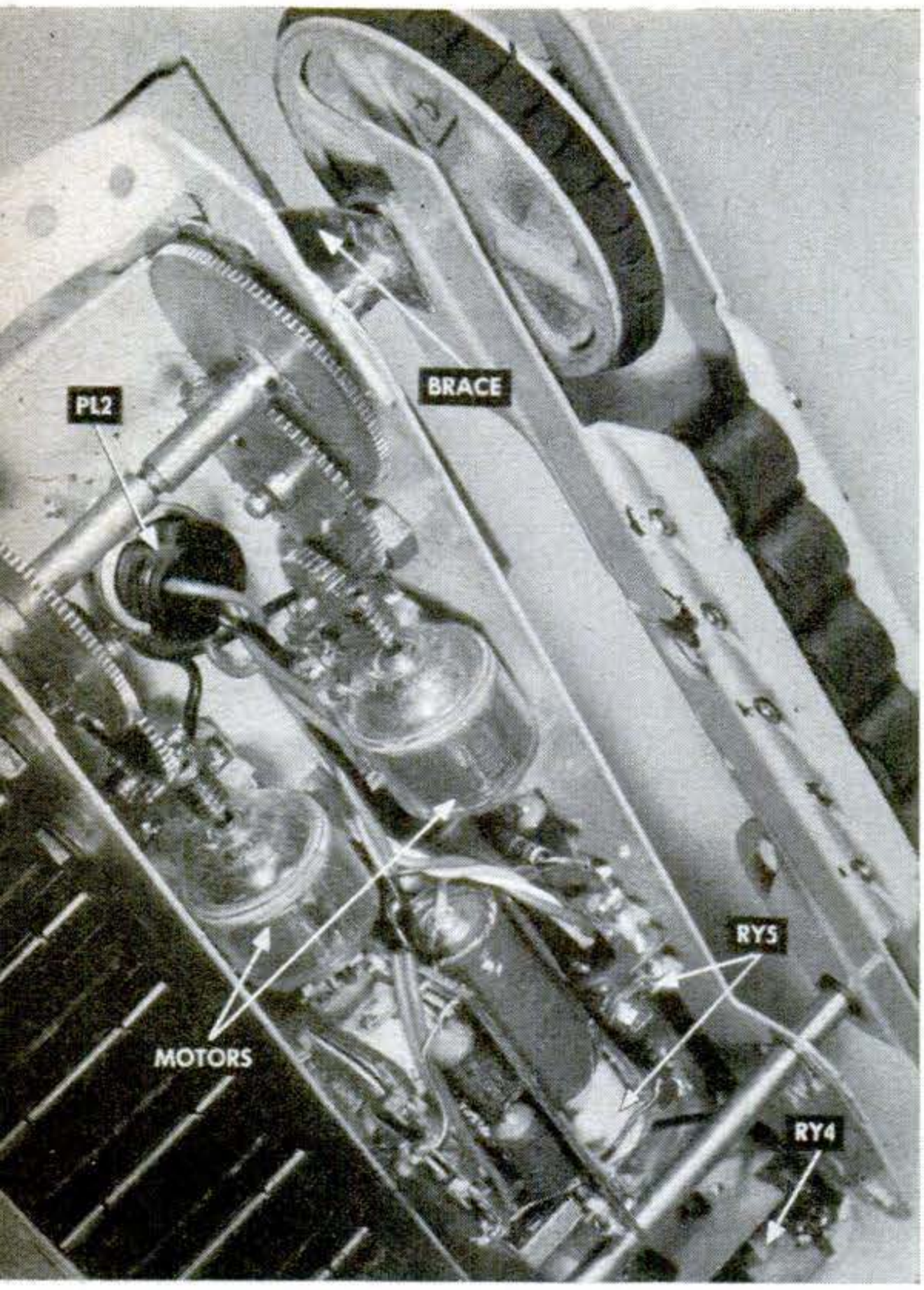


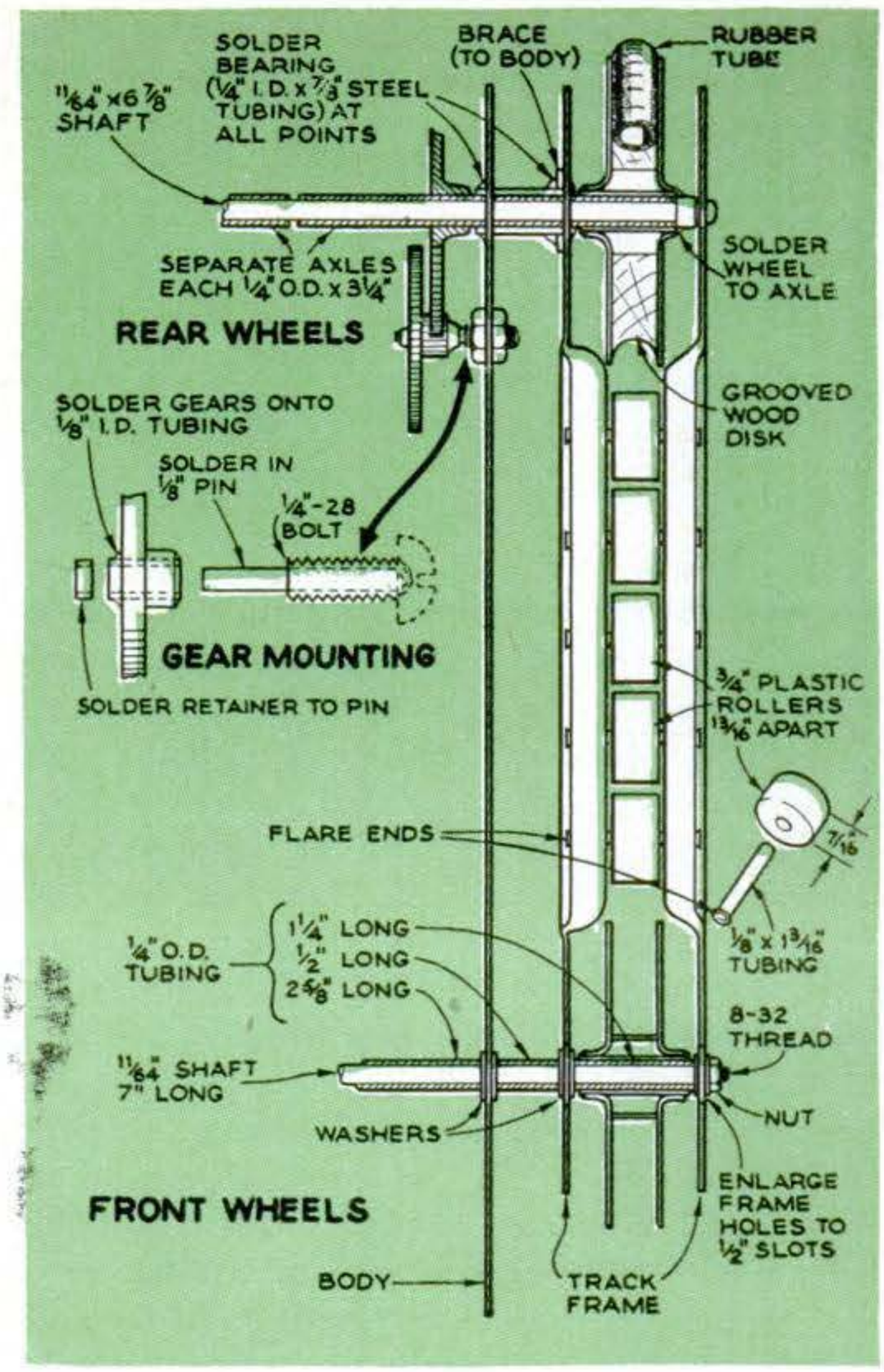
POWER AND CONTROL units are built into a pressed-steel toy. To remove tracks, pull pin from one link as shown. A 14″ piano-wire antenna is set into a plastic rod, threaded for a nut that jams it in the exhaust-stack hole.



RECEIVER KIT (above) includes parts, chassis and receiver relay, as well as instructions. Assembled as below, with flashlight A and hearing-aid B batteries, receiver goes under engine hood of tractor. The base and switch panel are cigar-box wood. Three-pronged plug connects to control unit.







ELECTRIC DRIVE under chassis should be protected if tractor is run in sand or grass. Axle holes in inside track frames are slotted upward for easy assembly. Brace from each axle bearing is soldered to body. Worm gear and second gear are soldered together as in drawing. So are third and fourth (intermediate) gears. Paired gears spin on studs.

of simply this straightforward yes or no?

Let's look at the receiver. Current from two tiny B batteries normally flows through the tube and the receiver relay. The magnetized core attracts a spring-tensioned armature to a contact point. But when a signal is received, it blocks the tube; little current flows, and the spring pulls the relay armature back against another contact point.

Through the relay points, a comparatively heavy current can thus be switched to two circuits, one if a signal is being sent, the other if no signal is sent.

Pulsing gives control. Instead of a steady signal, the transmitter sends an on-off pulse 200 times a minute. This makes the receiver relay flip from one contact to the other, sending current to first one and then the other of two low-voltage relays.

Each of these closes the circuit to one motor. But the relays do not open between pulses. A husky condenser across each one (C1 and C2) stores enough energy to hold it closed between pulses. Both motor relays stay closed and the tractor runs straight.

If you throw a steering switch on the transmitter one way, it sends a steady signal instead of a pulse. The receiver relay stays open, holding one motor relay closed and the other open. The tractor turns right.

Throw the steering switch the other way, and there is no signal at all. The receiver relay stays closed, sending juice to the other motor relay, and the cat turns left.

Stopping and backing. For these controls I added a rotary sequence relay out of an old electric train. The coil was rewound to work on the 4½-volt tractor battery, and connected to the points of an 8,000-ohm relay. The relay coil is coupled by a tiny transformer and rectifier to the motor-relay circuit.

An extra switch in the transmitter pulsing circuit, when pressed, increases the pulse frequency. The motor relays remain closed, but this higher frequency boosts power in the transformer circuit, so that its relay closes, actuating the sequence switch.

Motor current also passes through the

transformer-coupled relay, which cuts the motors as the reversing relay is energized, saving juice and motor strain.

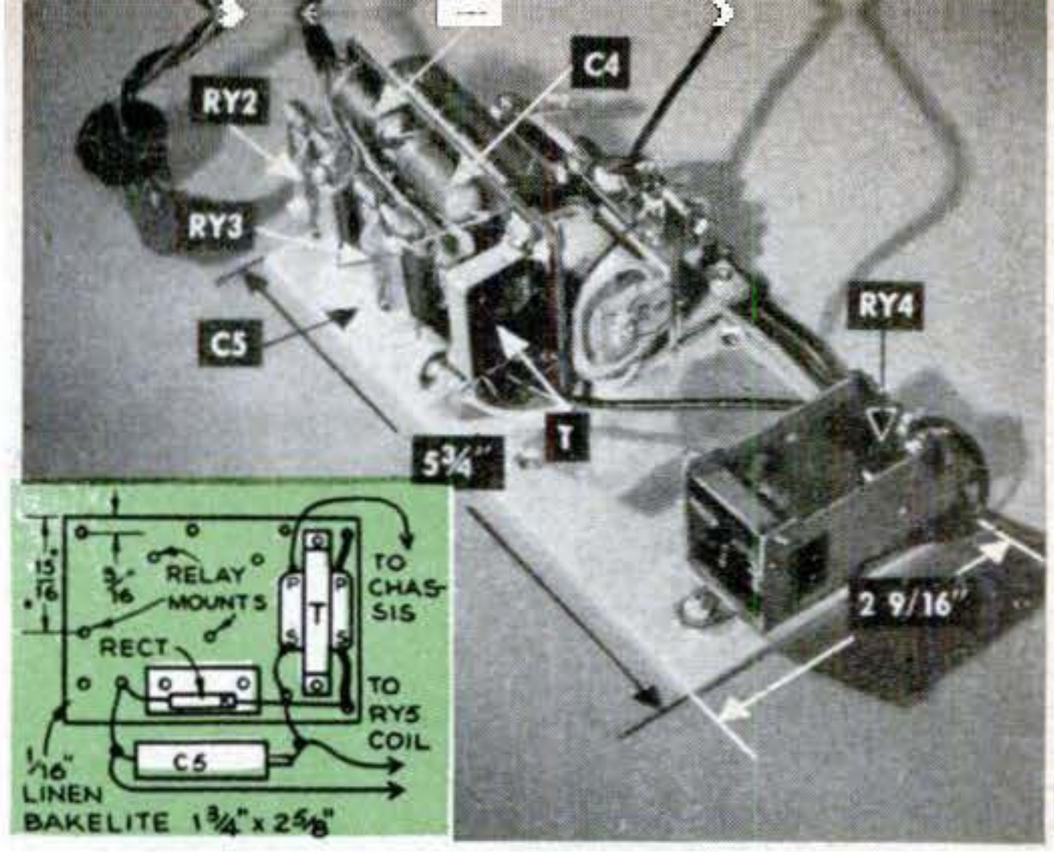
Just a touch of the transmitter button throws the reversing switch to the next step, the sequence being forward, stop, reverse, stop, as in the electric locomotive.

The power supply. A flashlight-cell A battery and two hearing-aid B batteries work the receiver. For the motors and relays, you might use six or more D-size flashlight cells in series-parallel, but a midget storage battery is a neater solution. Although high in first cost, it runs the tractor 2½ hours and can be recharged many times.

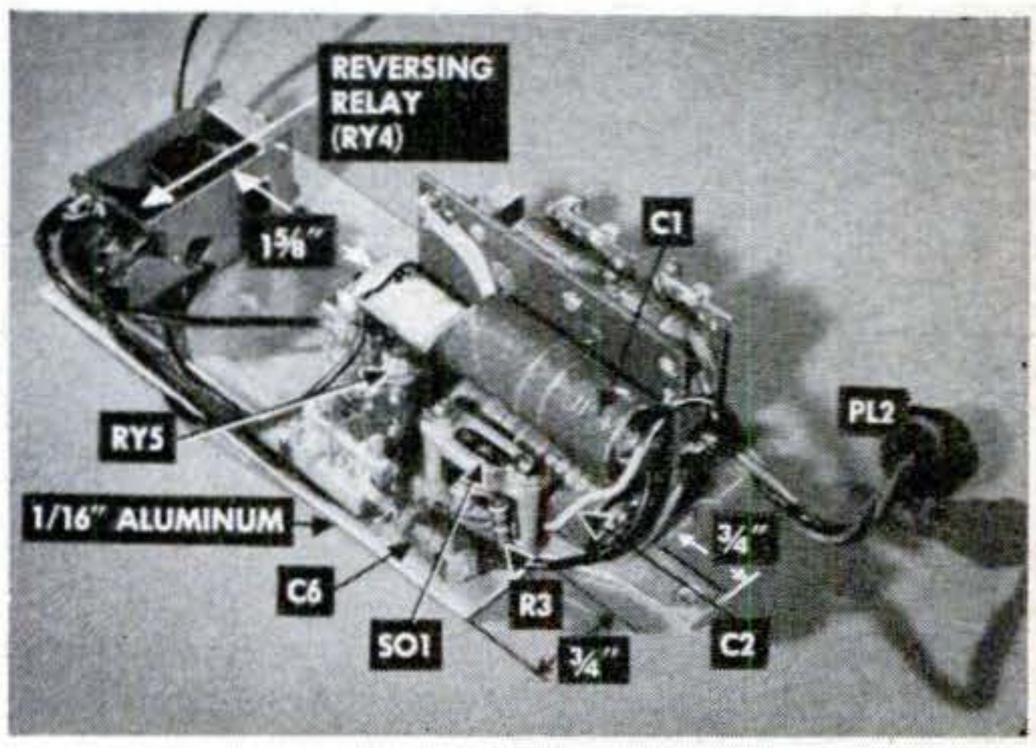
Building the units. I made the receiver and control units on separate bases with plug connectors for easy removal and servicing. Follow kit instructions to assemble the receiver. Mount it upright on a wooden base with small angle brackets. The two relay-point leads and one battery lead terminate in a three-pronged plug. The whole works slide under the tractor hood.

Setting the relays. Before they are installed, armature-spring tension must be reduced by removing the screw at the rear of each motor-relay frame and bending the spring inward. Tension should just suffice to snap the armature to the upper contact reliably when the coil is not energized. The upper contact should be bent to leave a gap of .006″ when the relay is powered.

RY5 must operate on very little current. With the armature brought within .010″ of

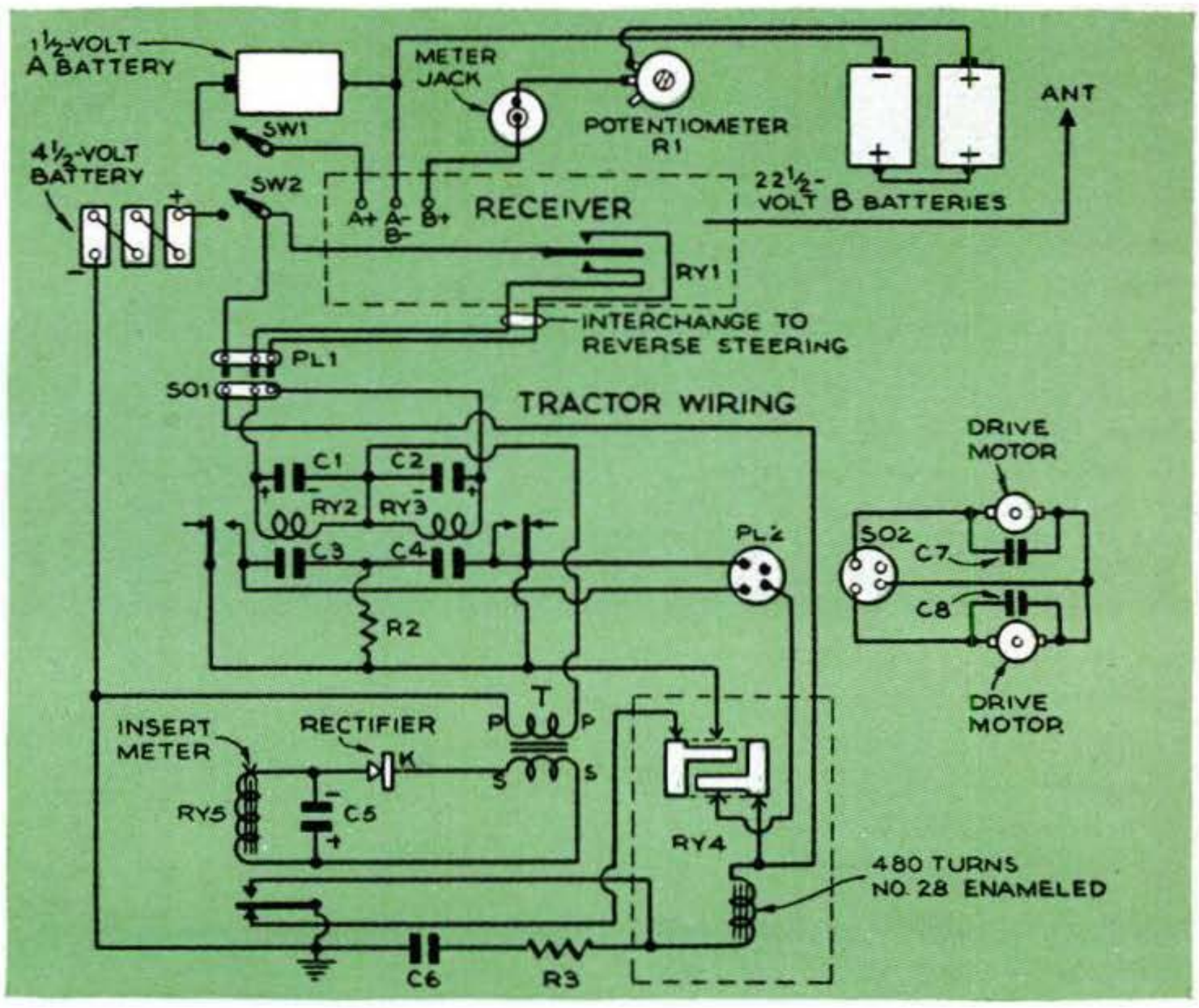


CONTROL SYSTEM, on aluminum chassis, is held in tractor by three screws, two of them run into wooden receiver base. Motor relays, transformer and rectifier are mounted on thin bakelite fabric held upright by a tiny bracket. Eyeletted holes around panel make handy wiring tie points. Transformer is held on by light metal band. Space the reversing relay as far from RY5 as possible to minimize magnetic interference.



LIST OF PARTS FOR RECEIVER AND CONTROL UNIT

Super-Aerotrol receiver kit with relay RY1
XFG-1 tube
2 22½-volt hearing-aid B batteries
D-size flashlight cell
SW1, SW2: SPST toggle switches
PL1, S01: miniature 3-prong plug and socket
PL2, S02: miniature 5-prong plug and socket
RY2, RY3: Price midget 6-volt, 80-ohm relays
RY4: reversing switch (rewind coil with 480 turns No. 28 enameled wire)
RY5: 8,000-ohm Sigma 4-F relay
C1, C2: 250 mfd., 6-volt electrolytic
C3, C4, C6: .1-mfd., midget paper
C5: 50-mfd., 12-volt electrolytic
C7, C8: 100-mmf. ceramic
R2, R3: 47-ohm, ½-watt carbon
Half-wave rectifier, Raytheon CK705
4½-volt power battery: three Silvercel LR3 midget storage cells or D-size flashlight cells



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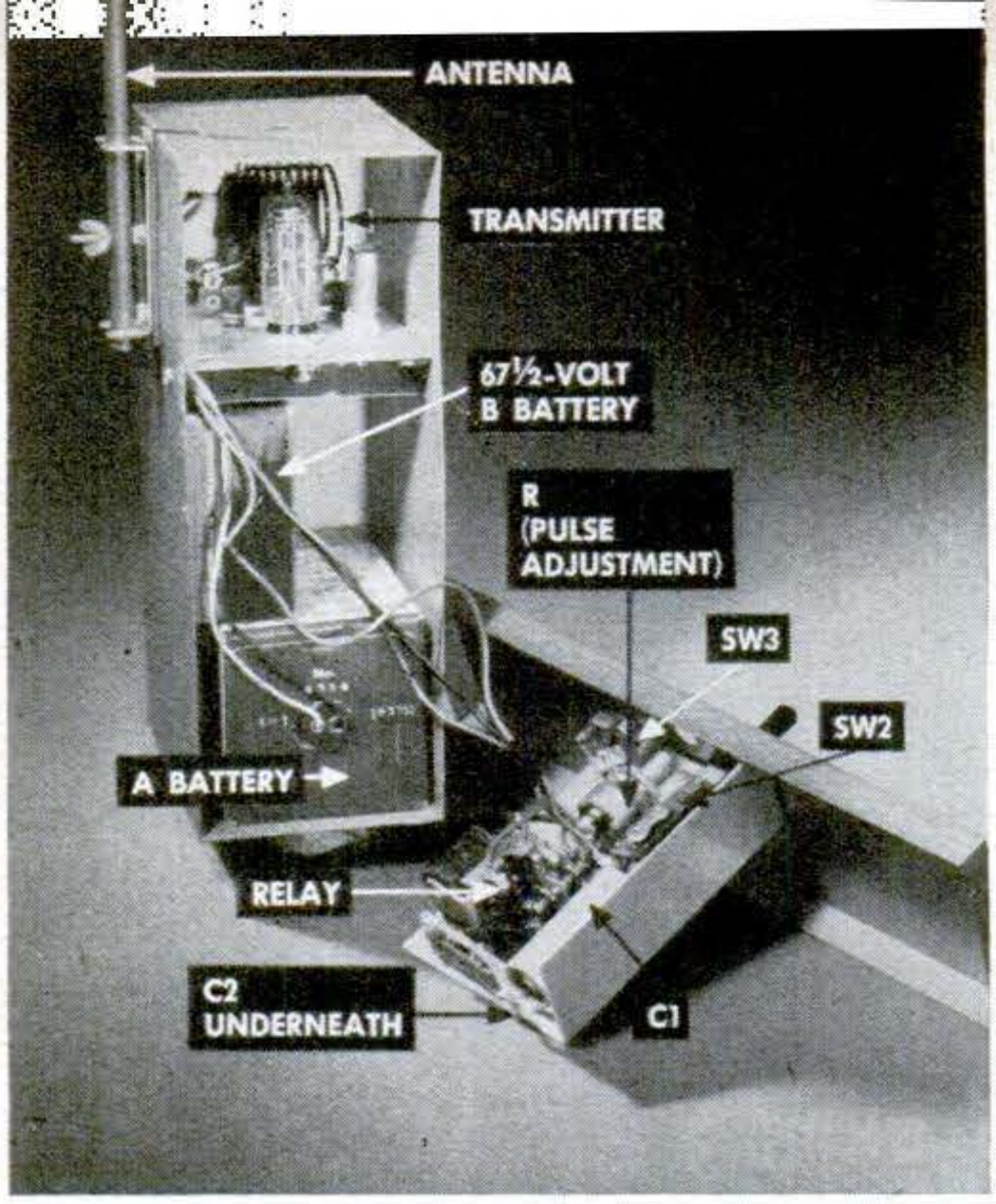
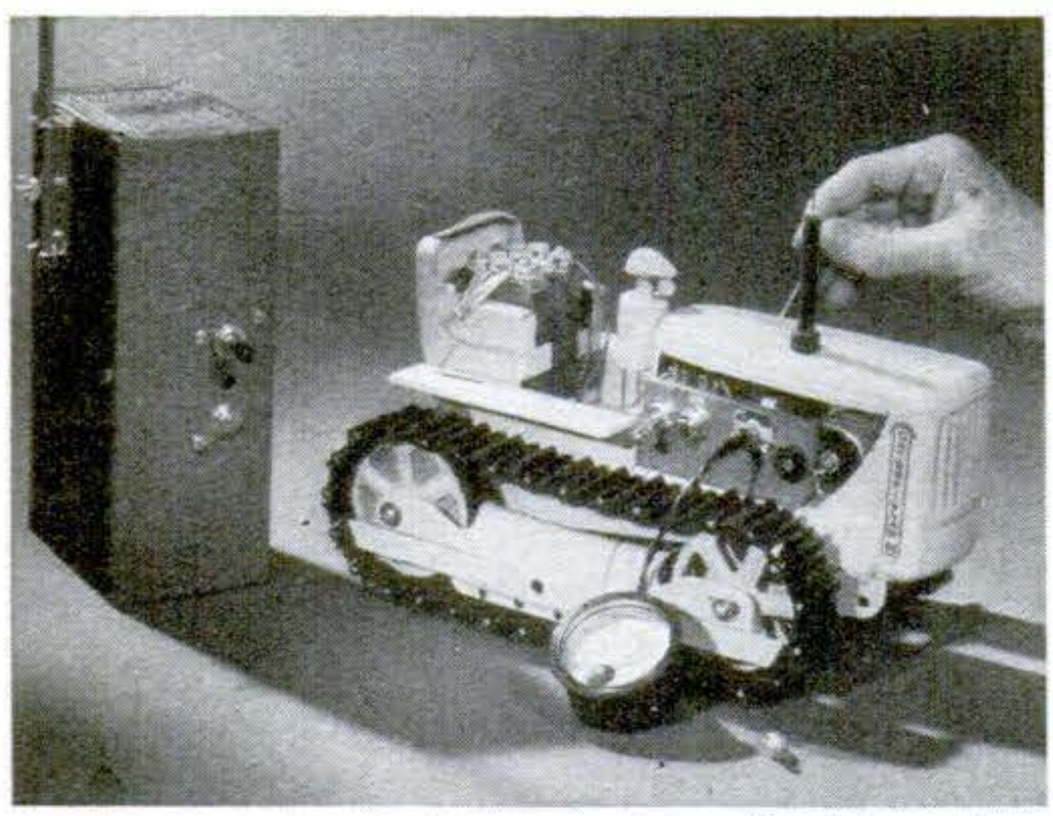


TRANSMITTER AND PULSER are housed in a trim case. SW3 is a normally closed switch, which opens when you push the button. The pulsing relay is one like RY5, and must be insulated from the chassis by mounting it on a bit of plastic. Replace on-off switch provided with a double-pole type that will cut the B supply as well as the A battery.



TUNE RECEIVER as instructed in the kit, using a low-range milliammeter. Meter jack in B-plus lead is convenient, as the tube changes characteristics with age and plate current must be adjusted by resetting the plate resistor from time to time.

the magnet, turn the outer contact in to leave a gap of only .0025". Armature tension must be adjusted with the rig working.

The transmitter. Assemble this according to instructions but substitute a double-pole switch for the one provided, and do not hook up the "key" switch at all. The pulsing circuit is mounted on a small aluminum chassis attached to the cover of the case, where it fits into the space ordinarily occupied by a second B battery. For the tractor, one 67½-volt battery gives enough operating range.

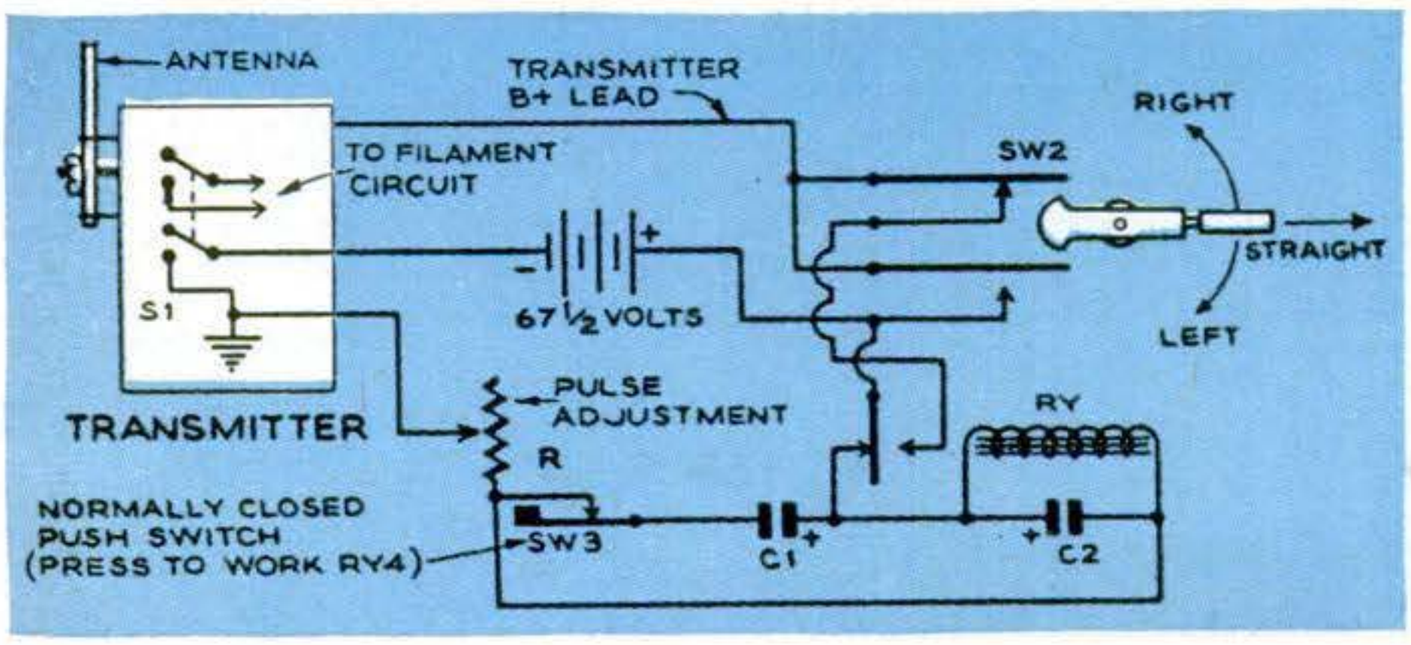
The steering switch SW2 must be hooked up to close the open circuit for right turn, and to open the closed circuit for left turn. To alter the switch for this operation, simply bend the contact leaves carefully.

Testing the outfit. Use a low-range milliammeter to adjust receiver plate current as in the photo. Then, leaving out the motor plug, turn on the transmitter, receiver and SW2 switches and see whether the motor relays stay closed (a magnifying glass may help). Then move the steering switch each way; first one, then the other motor relay should open.

Now hook the milliammeter in RY5 at the point X in the drawing. With the transmitter pulsing, it should read about .5 ma. If it is much less, reverse the transformer primary leads P-P. If it is still low, better check the rectifier and condenser hookup, which must be as shown, with the K on the rectifier toward the transformer.

Next, push the transmitter reversing button. The current in RY5 should rise to about .9 ma. Adjust armature tension until this current operates RY5 reliably, when the reversing relay RY4 should work. If RY5 does not release promptly, throwing the steering switch to either side an instant should kick it out.

If the tractor turns left when you push the steering switch right, simply reverse the leads from the receiver relay. END



LIST OF PARTS FOR TRANSMITTER AND PULSING UNIT

Super-Aerotrol transmitter kit
3A5 tube
1½-volt A battery
67½-volt B battery
RY: 8,000-ohm Sigma 4-F relay
SW1: DPST switch
SW2: Switchcraft 3037 steering switch
SW3: Switchcraft 103 normally closed push-button switch
R: 25,000-ohm potentiometer
C1: 20-mfd., 150-v. electrolytic
C2: 5-mfd., 150-v. electrolytic

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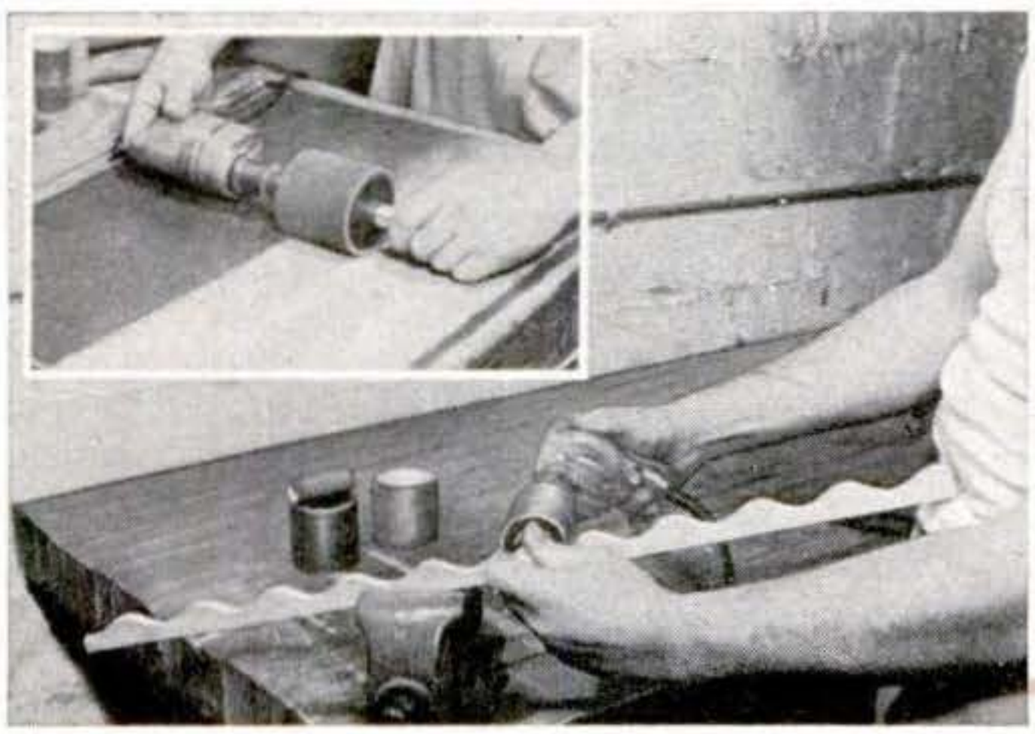
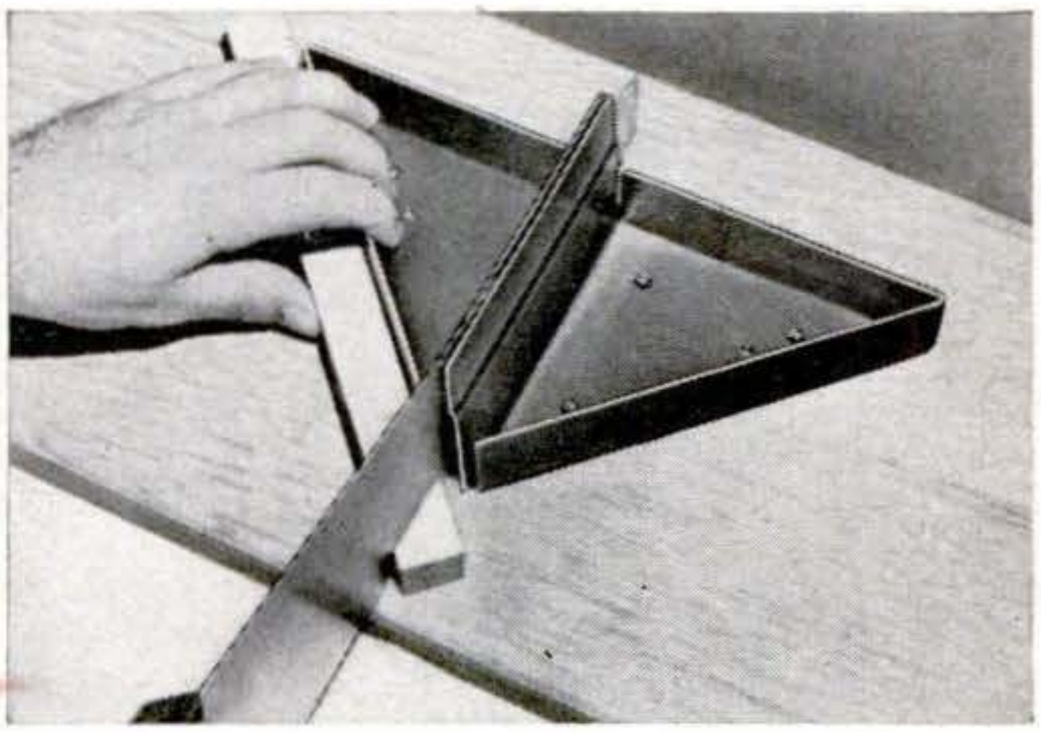
New Tools

1 Circuit Tester Fits Pocket. House circuits, shop motors and electrical appliances can be quickly checked for either voltage or amperage with this inexpensive, pocket-size meter. To measure amperage (left, above), the meter is simply hooked around one of the two circuit wires. To check voltage (center), test leads are plugged into the back. The meter will measure up to 25 amps and up to 250 volts. A separate plug-in accessory with a hole in the center (right) divides a two-wire line, making it easy to hook the meter over one wire without cutting into the cord. A switch also makes it possible to multiply low readings 10 times for greater accuracy.

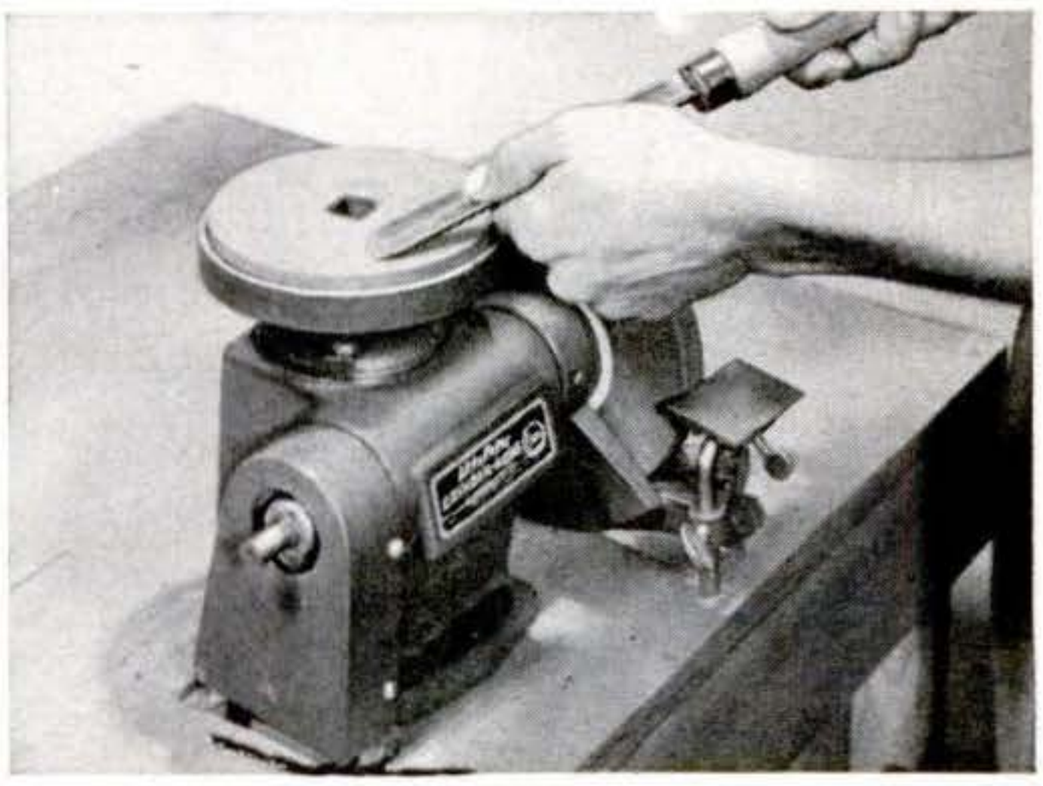


2 Drum Sander Has Three Sizes. This drum sander for ¼″ electric drills lets you choose three sizes of sanding sleeves without switching to other attachments. A telescoping arrangement takes 1″, 2″ or 3″ drums, and a free-wheeling pilot bearing on the outer end provides a handgrip to steady the drum for better control.



3 Miter Guide Can't Wobble. You shift the work instead of the saw to change the cutting angle on this heavy-gauge steel miter guide. The single long slot keeps the blade from wobbling, can't wear and makes it easier to visualize intricate cuts. The two metal triangles are simply screwed to any bench or board.

4 Grinder Has Hone, Too. All types of sharpening can be done on this grinder-hone. The grinding wheel turns at 3,000 r.p.m., while the oilstone on top is geared down to 110 r.p.m. The two-sided hone, which can be quickly lifted off and turned over, has 120 grit on one side for whetting and 320 on the other for final honing. Sanding, buffing and brushing wheels can be mounted on the left-hand end of the shaft.



Further information on these products can be obtained from: 1. Pyramid Instrument Corp., Lynbrook, N.Y.; 2. Bertram Engineering and Supply Co., 3125 Harrison St., Kansas City, Mo.; 3. Eagle Products, P.O. Box 84A, Meriden, Conn.; 4 Atlas Press Co., 2542 N. Pitcher St., Kalamazoo, Mich.

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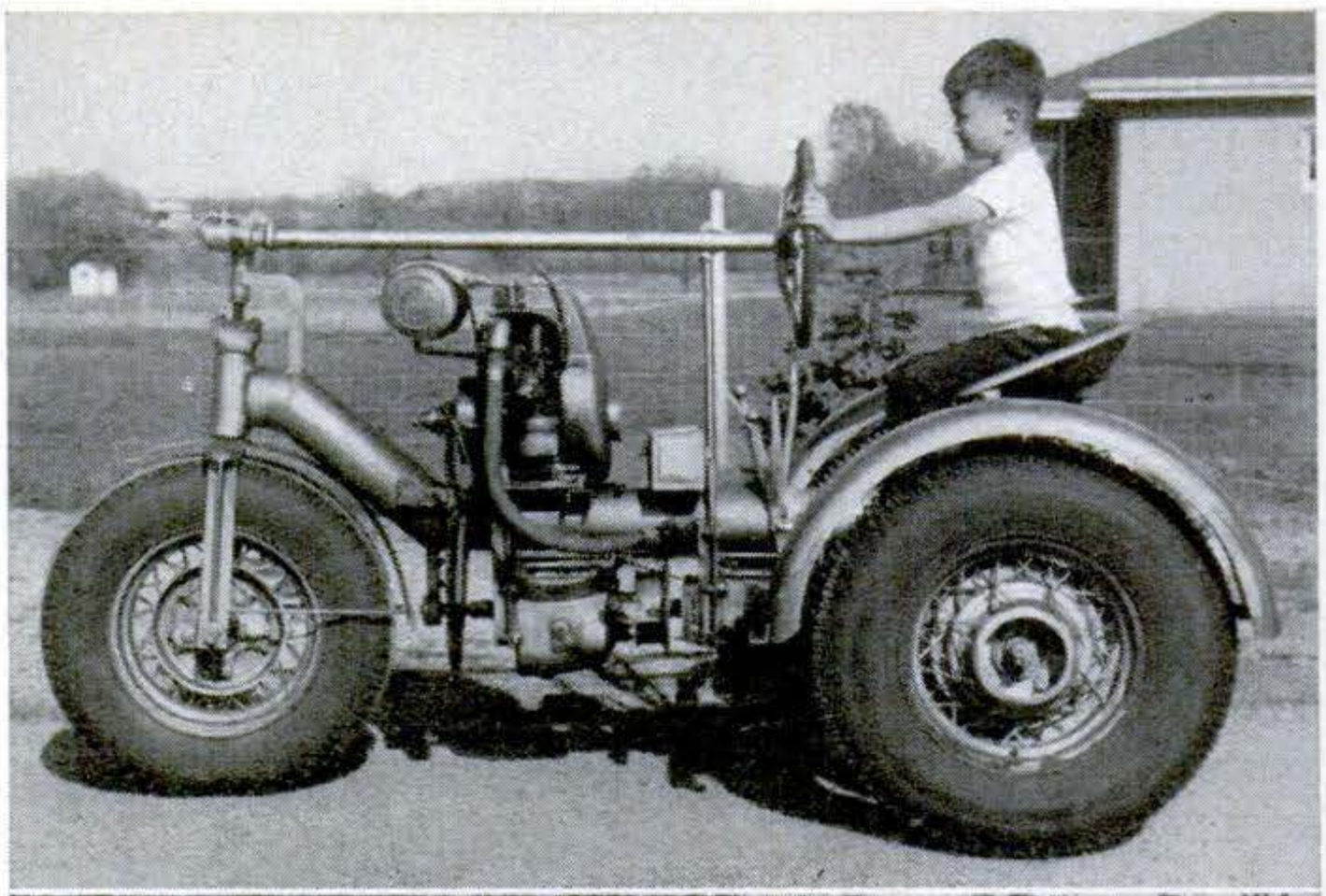
Back-yard mechanics aren't lazy—just too smart to hitch their backs to a job a put-put can do better.

Gardening with Gasoline

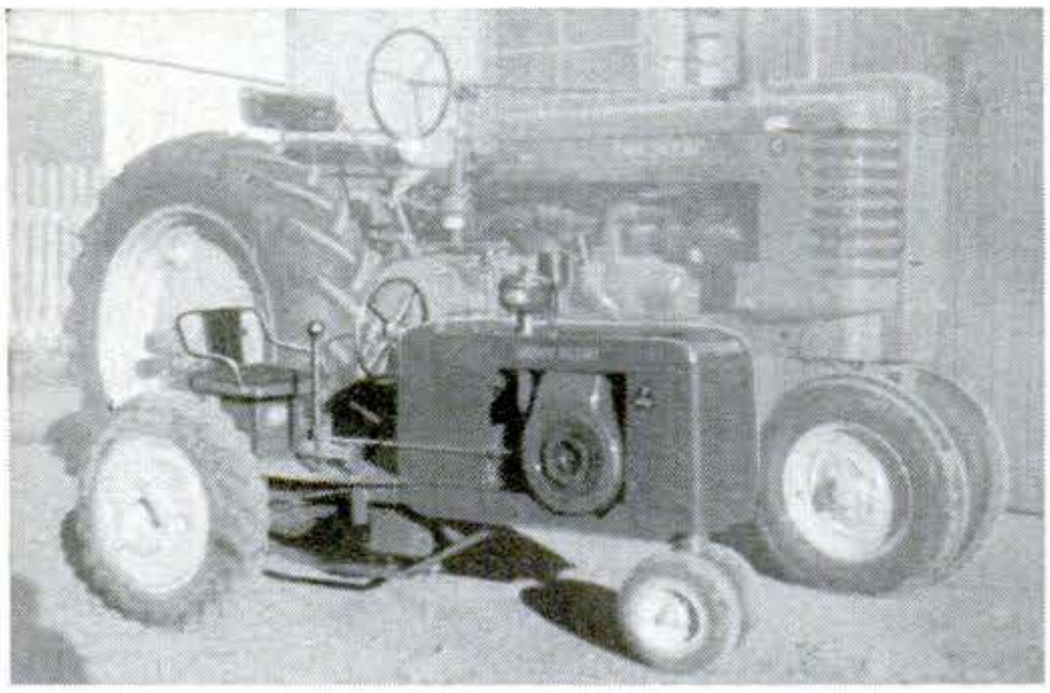


Sporting wire wheels like the flashiest cars, Joseph Jacobs' big homemade tractor pulls a full-size harrow. It can also power a 4′ sickle mower and an orchard-spray pump, both home-built. A centrifugal clutch on the engine provides simple control with a single lever.

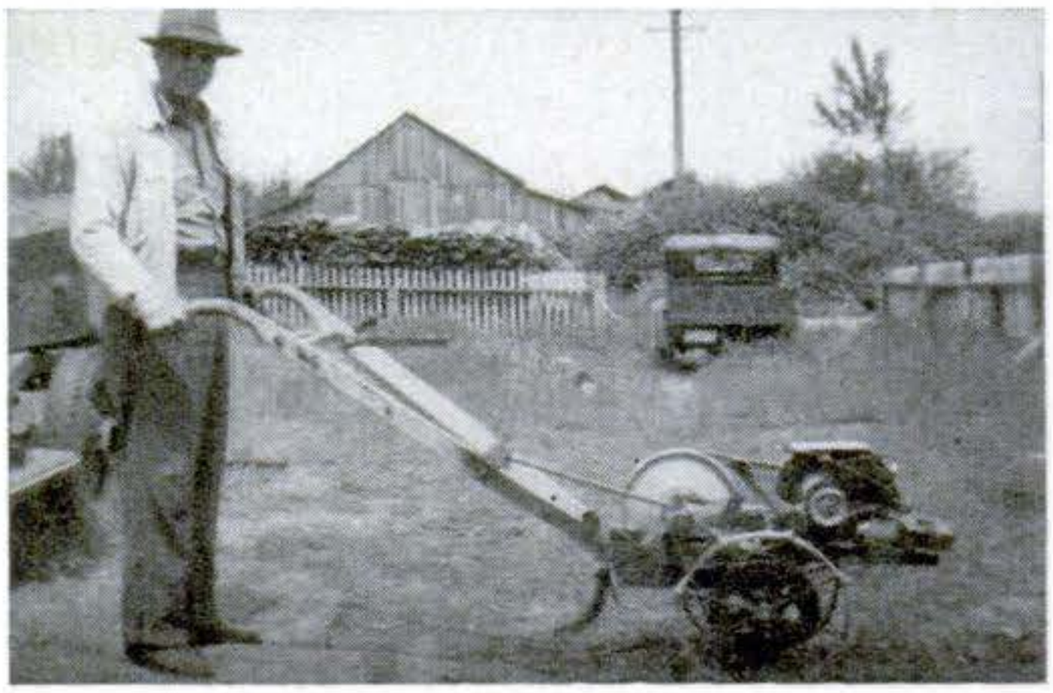
THE handy men who make their own garden tractors don't give an inch to the professional designers of commercial machines. Their homemade rigs appear in as many shapes and sizes, will do as many different jobs—sometimes more—and almost always boast a far more unusual ancestry.

Some are as big as respectable farm tractors. The one shown at the top of this page, built by Joseph H. Jacobs of Osseo, Minn., started out as some 6″ pipe and a collection of auto parts. The pipe was welded into a frame and fitted to take the engine exhaust so that the frame also serves as a muffler. The seven-hp. engine drives an automobile rear axle, shortened 6″ at each end, through two car transmissions. This gives a wide range of speeds for efficient operation of a number of implements. The tricycle design permits the tractor to turn in its own length.

Another enthusiastic tractor builder, Robert K. Chess of Kelso, Wash., has made a



Junior job. Shown alongside a full-size tractor, Lester Foulke's midget is powered by a six-hp. four-cycle engine. The drive is through a gearbox to the transmission and differential of a '37 Hudson. Top speed in high is eight m.p.h.



Powered plow handle. Hitching a ¾-hp. gas engine to a light plow handle made this maneuverable garden cultivator. One of several types built by Robert Chess, it has a ratchet on each wheel to let either stop for turns.

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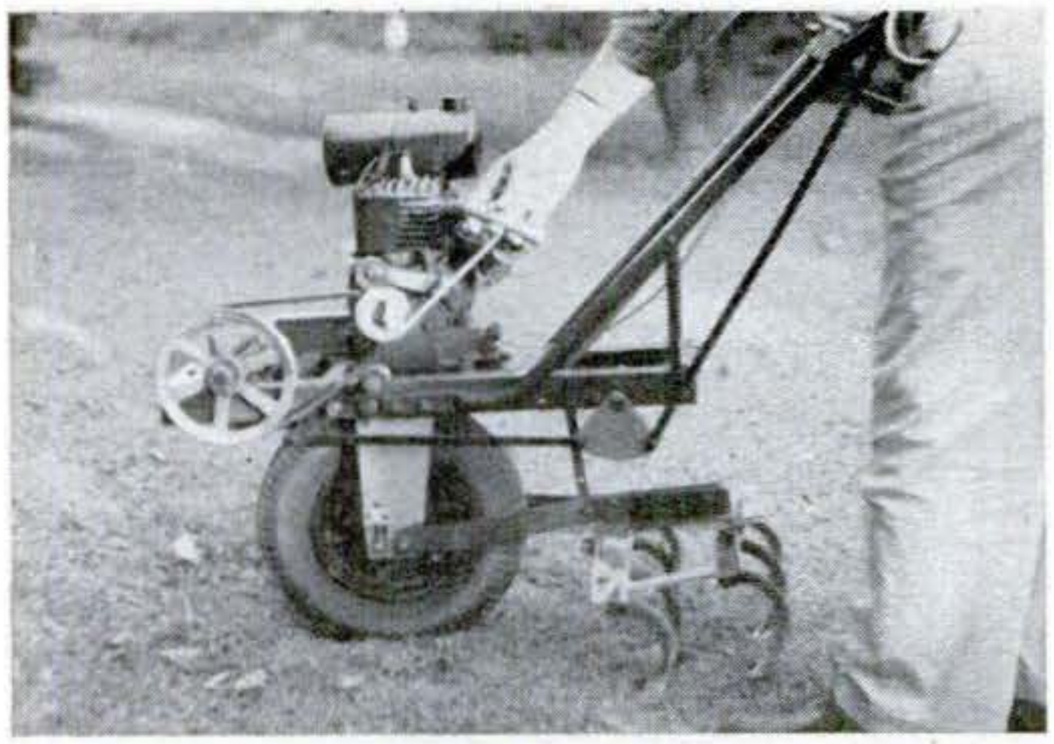
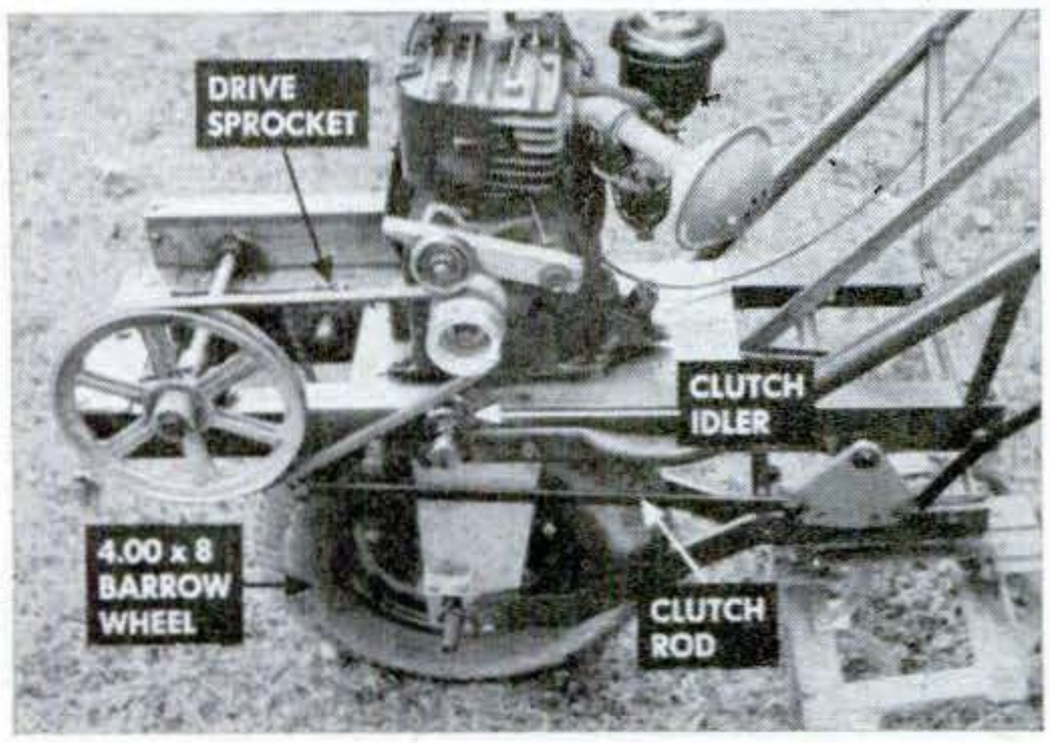
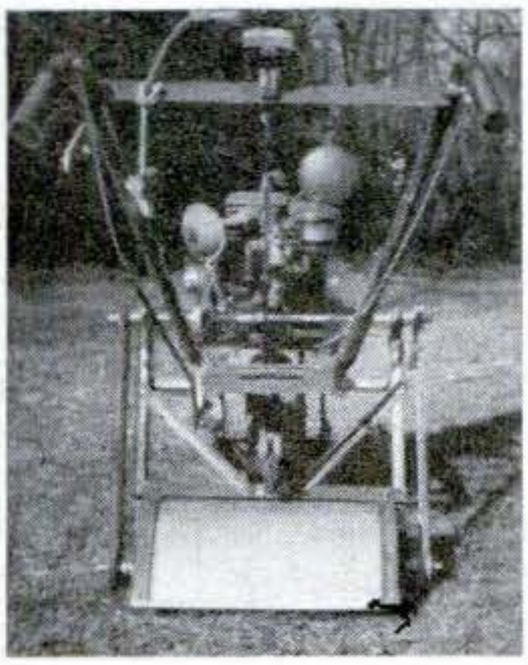






With just one foot on the ground, this 1½-hp. engine does chores from cultivating to snowplowing. Bradford Dittmer of Bellmore, N. Y., made it. Belt, reduction gear and bicycle chain (directly above) give over-all ratio of 33 to 1. Clutch on left grip (right) must be held, giving quick control.

profitable sideline out of assembling machines on order. Into some of his larger rigs have gone engines from a '28 Whippet, a Model A Ford and a Durant four.

At the other end of the scale, all kinds of walking tractors have been built, some no bigger than a power lawn mower. One of the most unusual is the "Little Cat" made by D. F. Meyers of Ashland, Ky. It rides on crawler tracks that Meyers reworked from a war-surplus bomb-carrying dolly. A 1½-hp. Briggs & Stratton engine drives it.

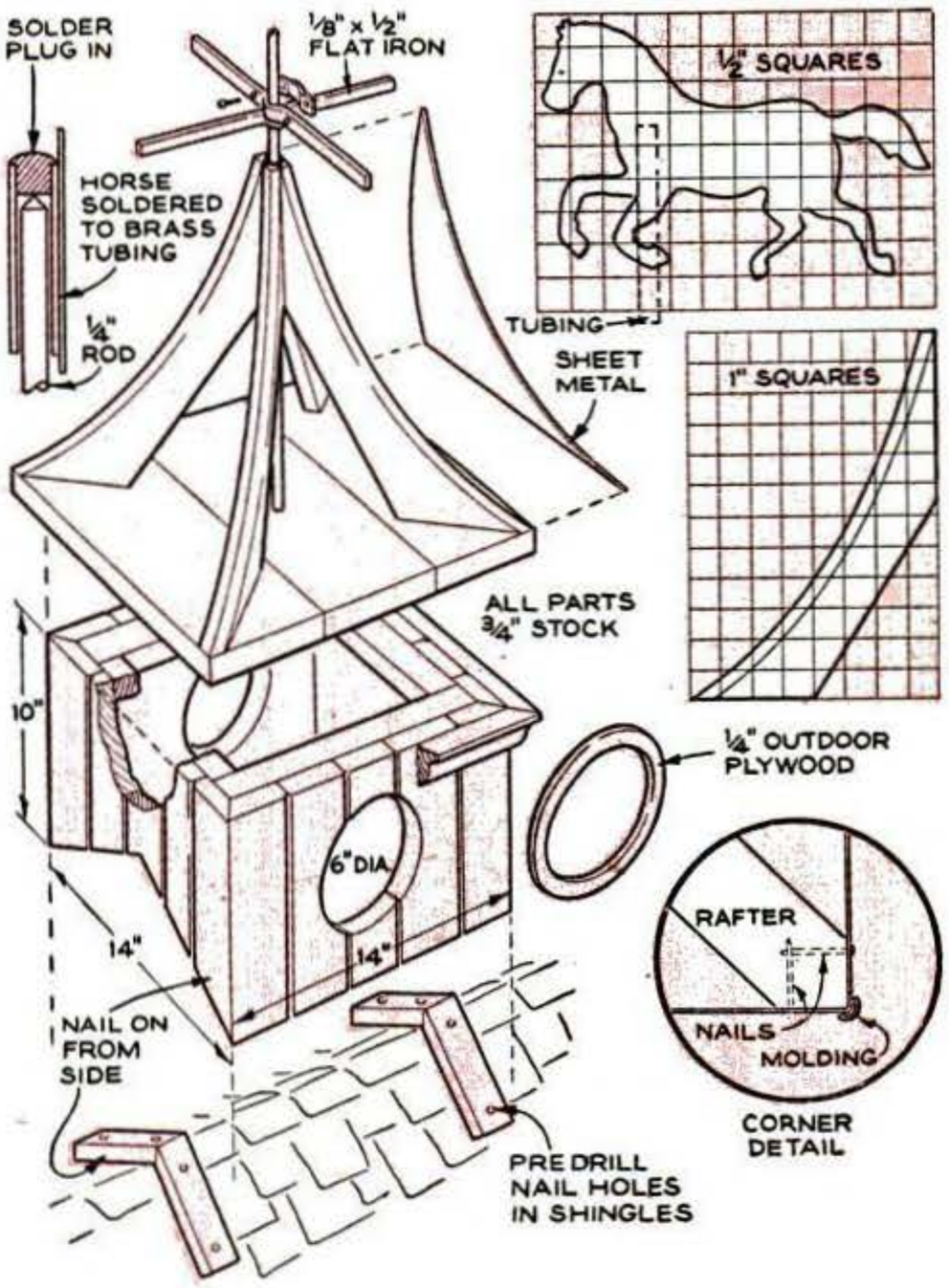
In-between in size are scaled-down versions of commercial farm machines, resembling kids' toy tractors but able to do real work. Often they are careful copies. The one shown on the opposite page, the work of Lester T. Foulke, Cheyenne Wells, Colo., even has the name painstakingly painted on.

Cupola and Vane Trims House Roof

THIS midget cupola with its sassy little weather vane will set any house off from its neighbors. You can add it without lifting a shingle.

The body can be built up of one-by-three stock (actually ¾" thick) with cleats and butted or mitered corners. Use brass or copper nails. Four rafter-like pieces on a flat top support the vane shaft. Trace around two while holding paper against them to get a pattern for the sheet-metal roof sections. Solder the corners or cover with molding as shown.

Louvers inside the windows can be built up of wood or metal, or bought in the form of attic vents. Solder the sheet-metal horse to a bushing that turns on the fixed shaft. Solder cutout metal letters to the compass points if desired, and clamp the points on with brass bolts.



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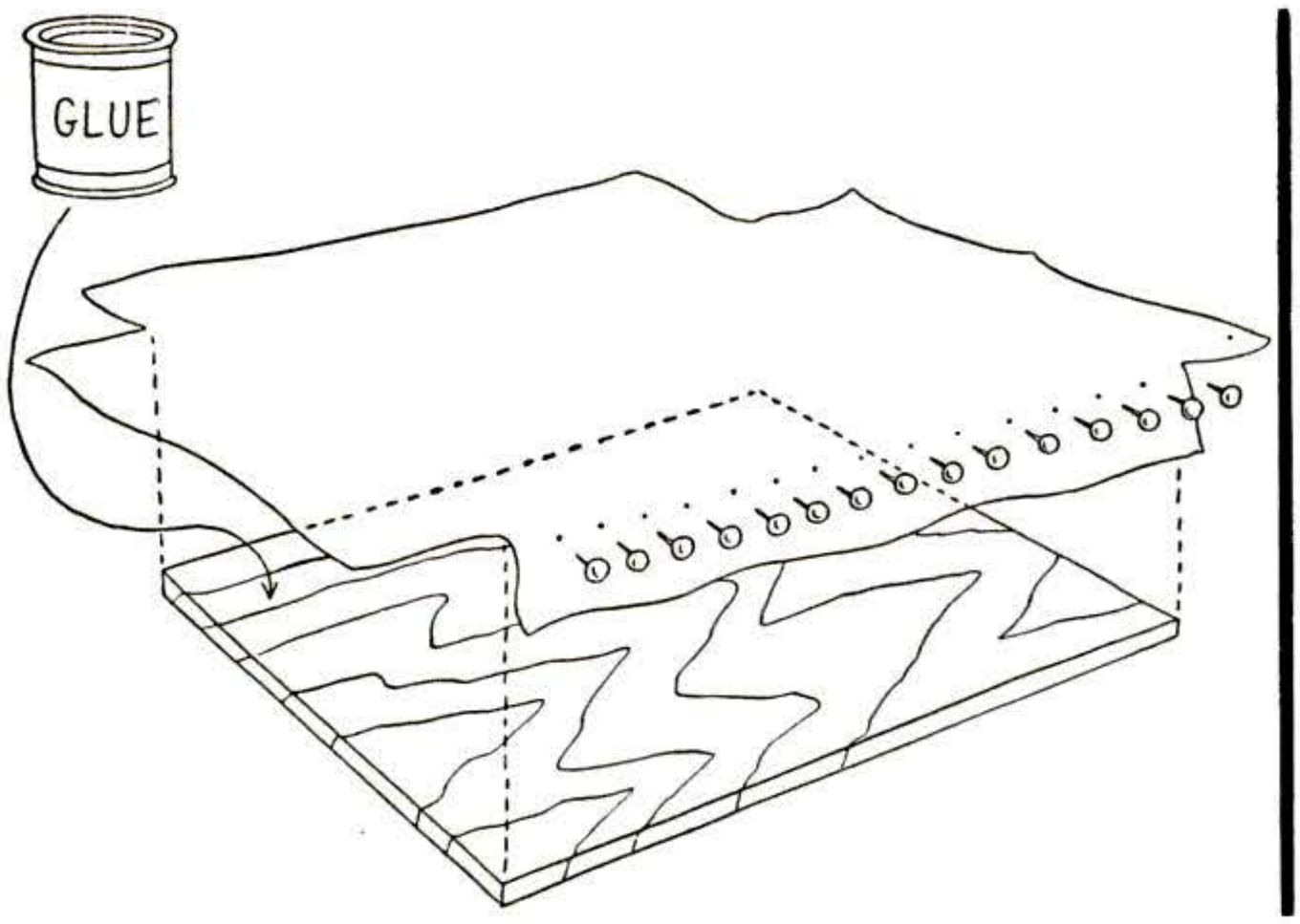
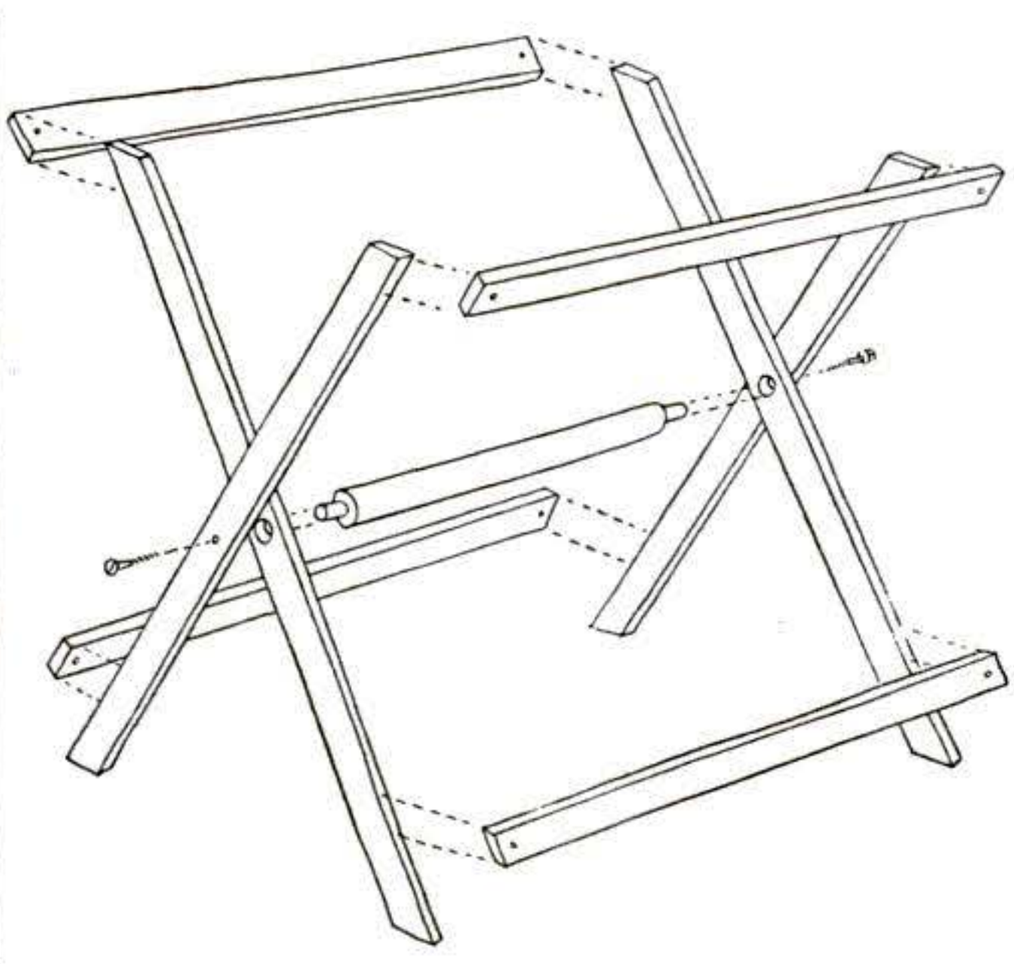
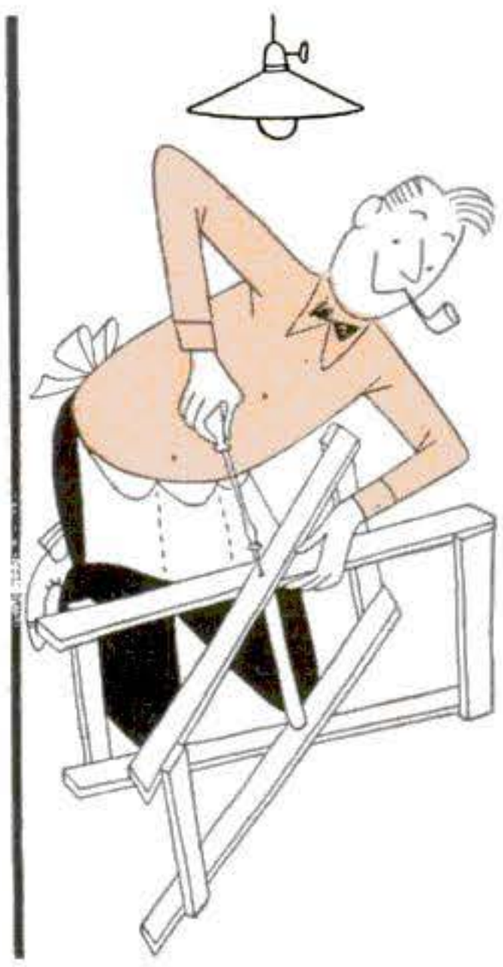
Wordless Workshop







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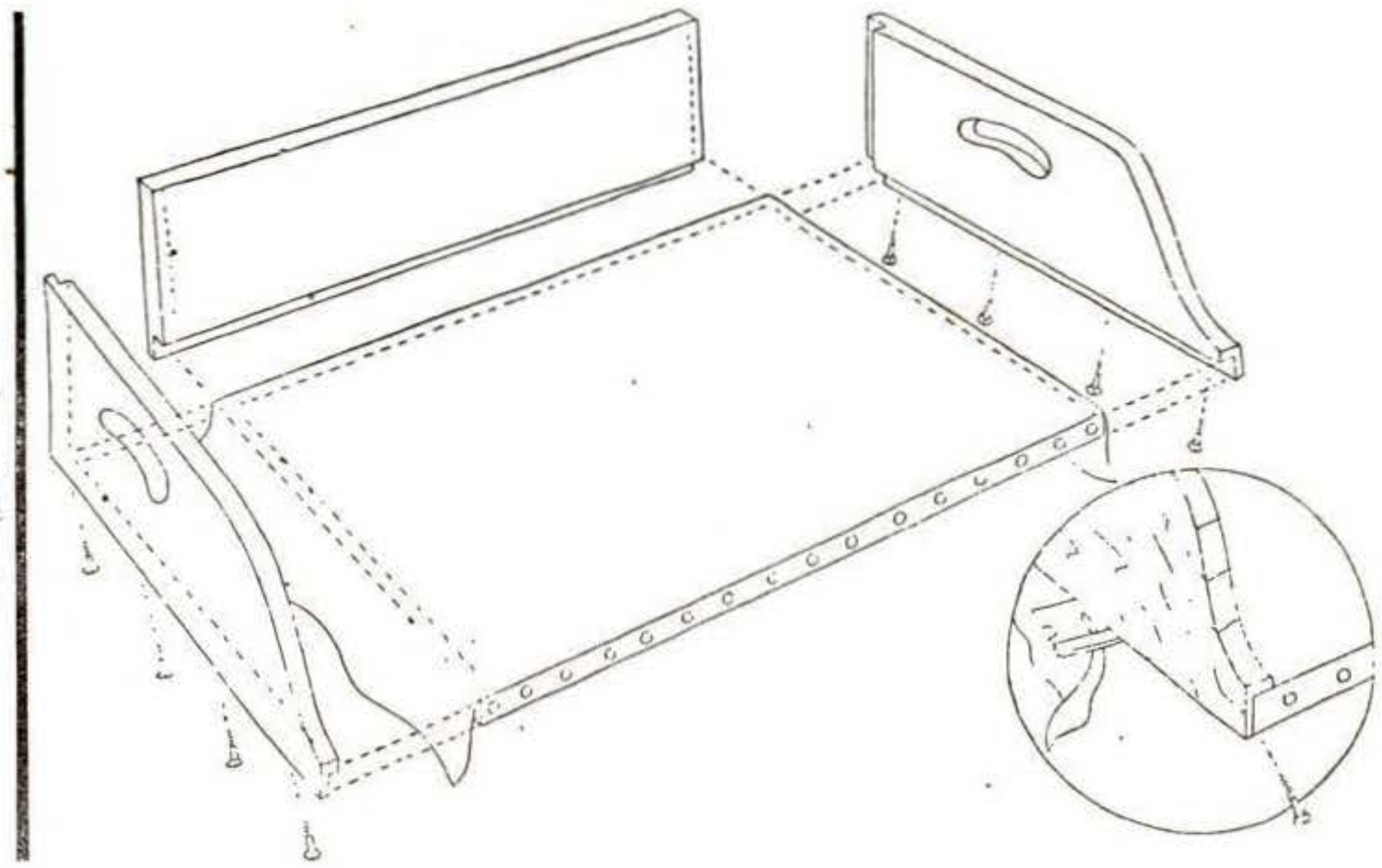

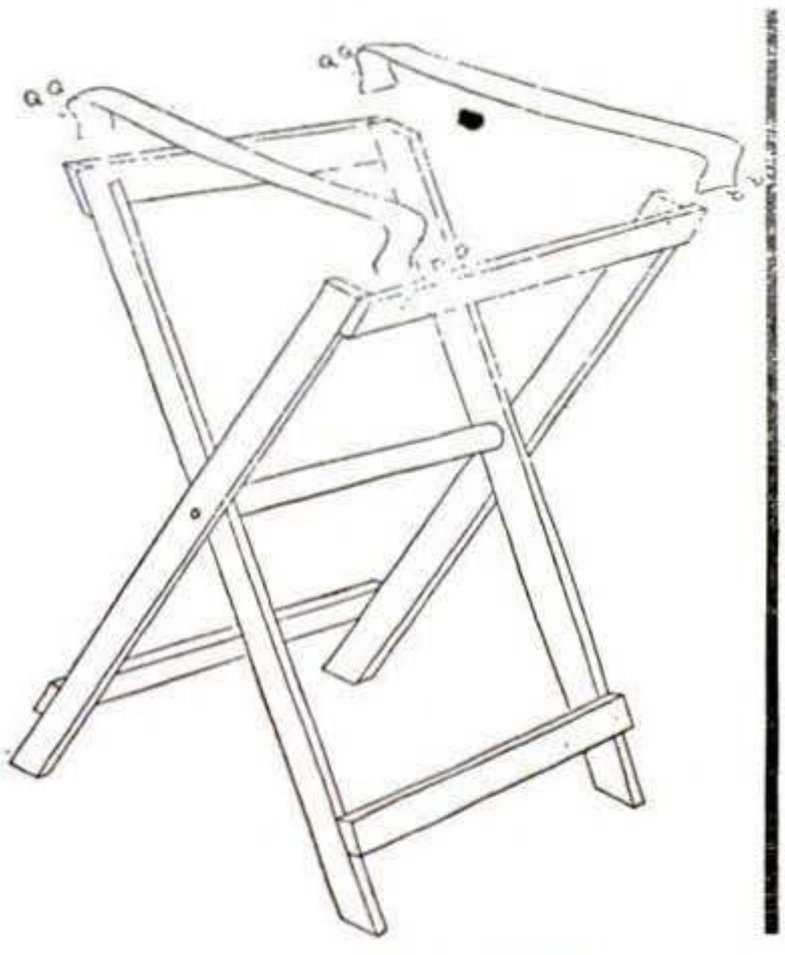

See PSM next month for another Wordless Workshop.

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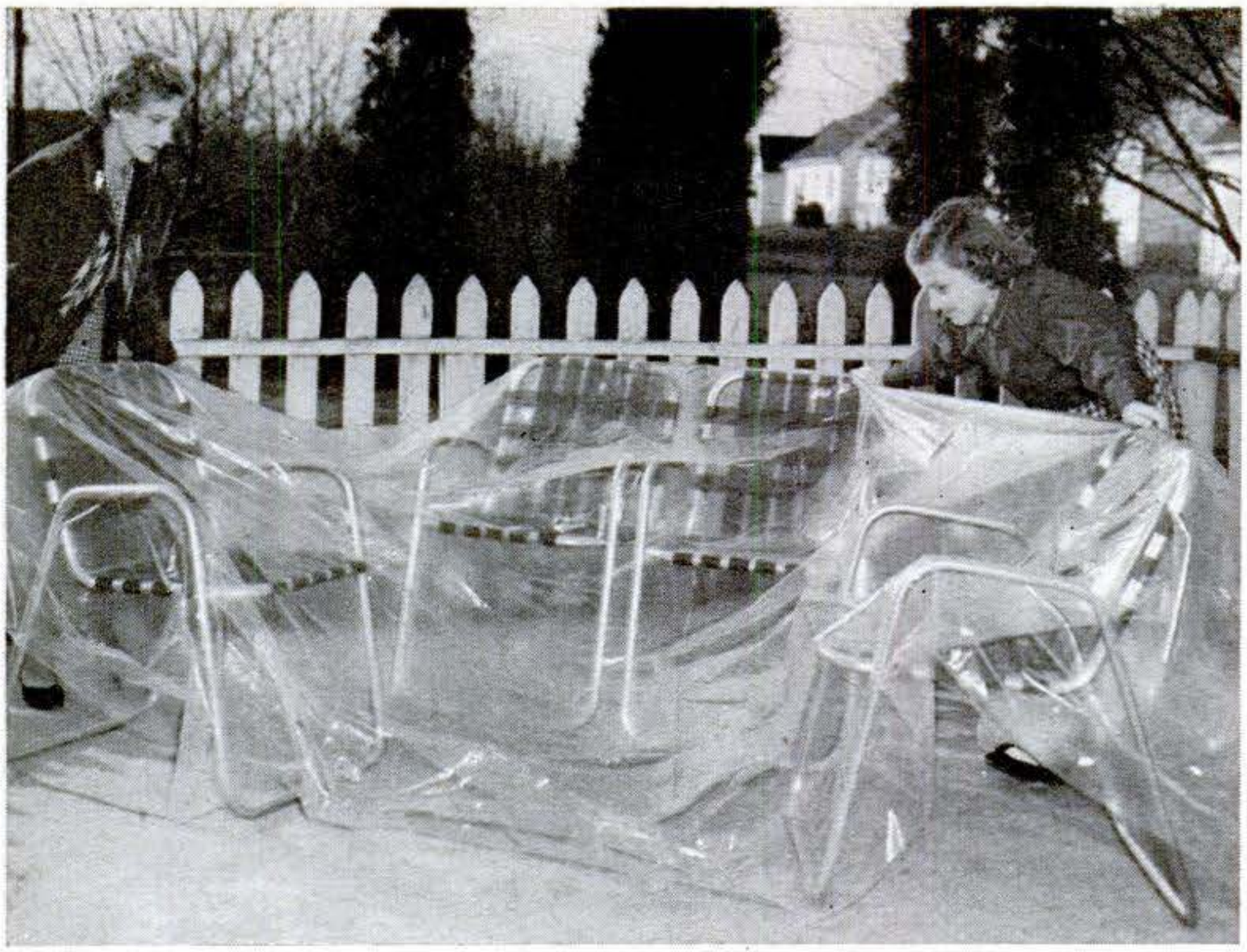
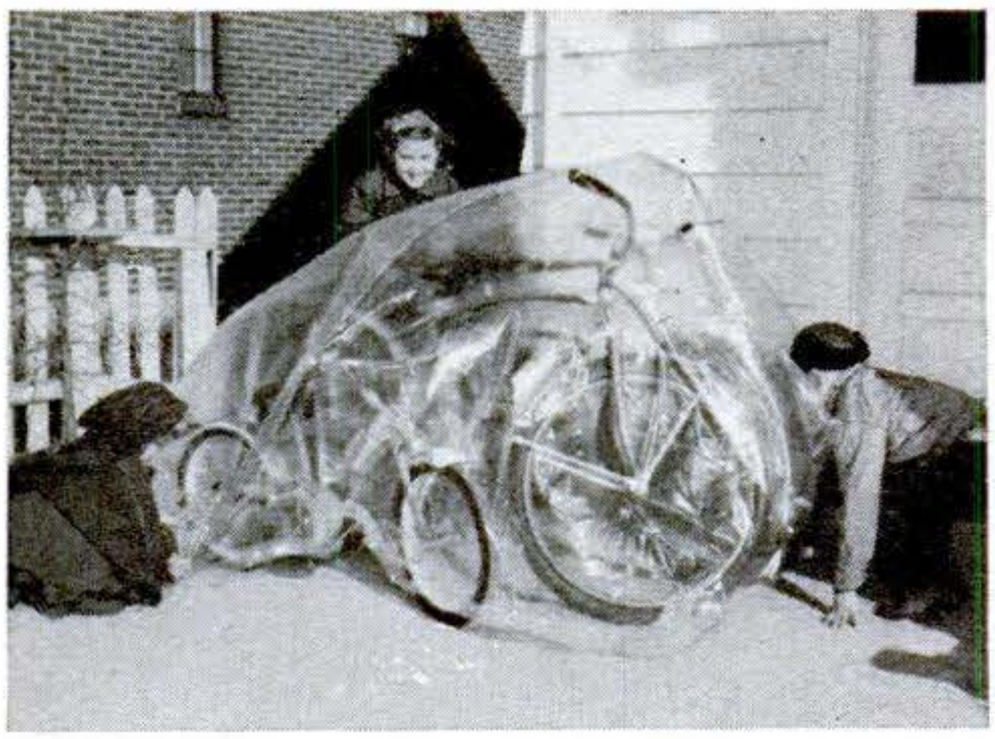


Shower coming? Then grab one of your plastic covers and spread it over the outdoor furniture to avoid lugging the furniture around. The 9′-by-12′ size shown here was originally made by the Sydney-Thomas Corp., Cincinnati, for use as a painter's drop-cloth.

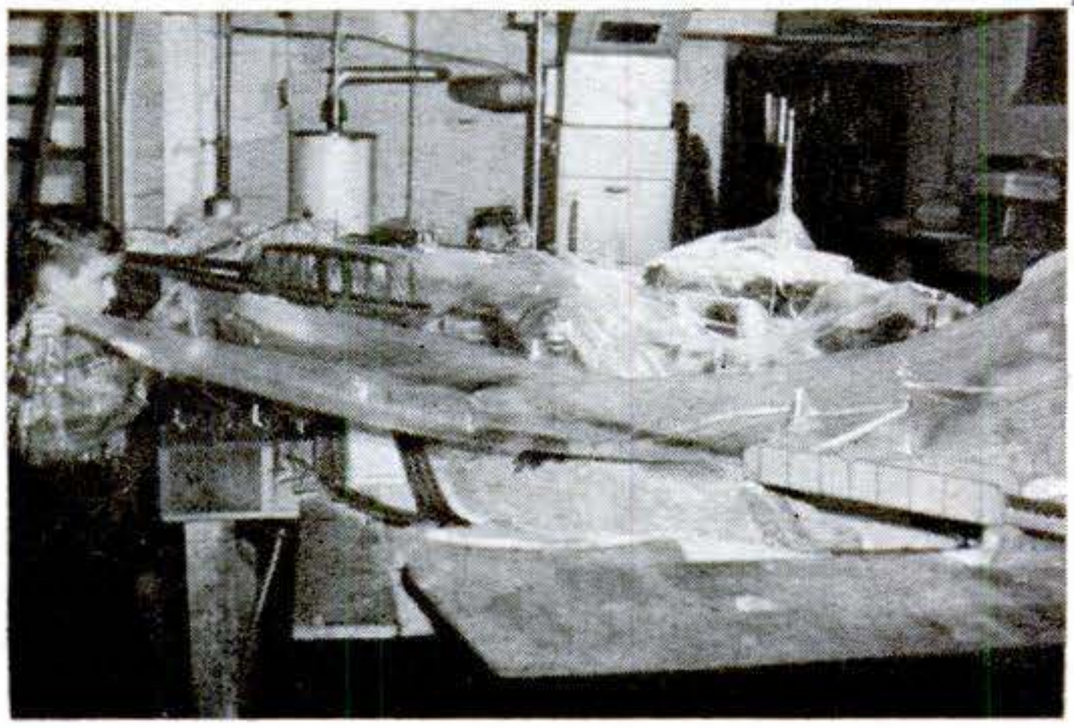
You Can Use Plastic Covers

Big sheets of transparent, weather-resistant polyethylene are now available at low cost to handle various chores in and around your home.



Garage the bikes under a cover each night if there's no space elsewhere. The plastic won't hurt chrome or paint, and isn't affected by freezing, hot sun, acids or alkalis, or petroleum products. Prices are about $3 for the 9′-by-12′ size and $1.30 for the 6′-by-9′.

Protect workshop tools from dust. It takes only a few seconds to throw one of the big sheets over all your important equipment.



Cover a model-railroad layout in the basement or in the attic to keep off the dust.

and you can also use it . . .

1. **As an outdoor picnic cloth.**
2. **As a car cover.**
3. **As an emergency raincoat.**
4. **To make a wading pool.**
5. **As an outdoor play pad for a baby.**
6. **To protect a bush from frost.**
7. **As a trailer cover.**
8. **As a mattress cover.**

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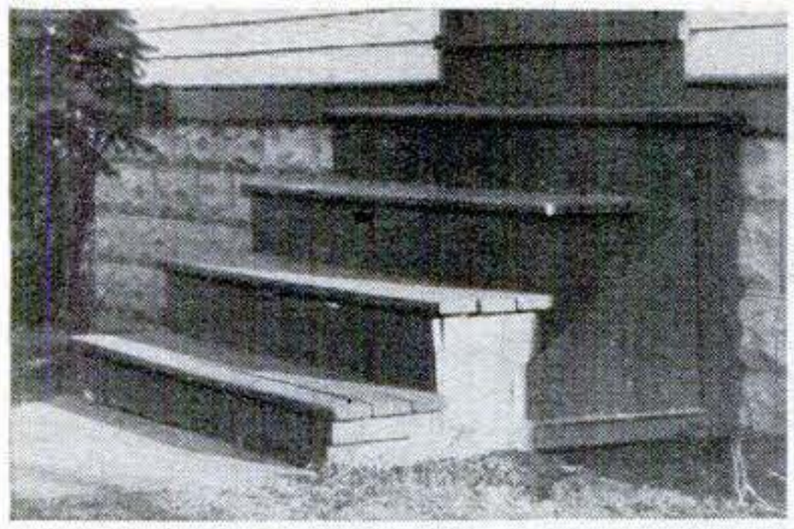
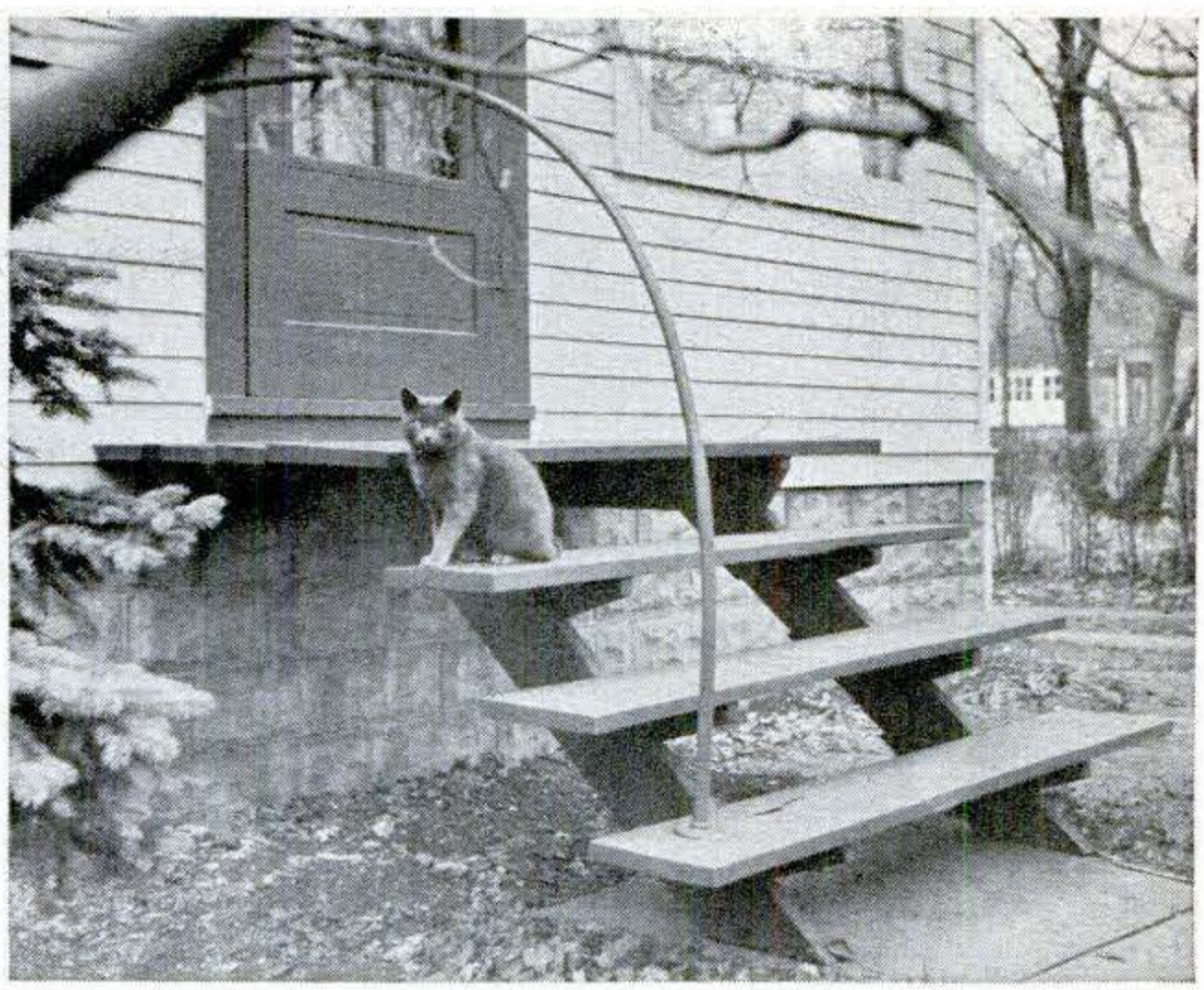
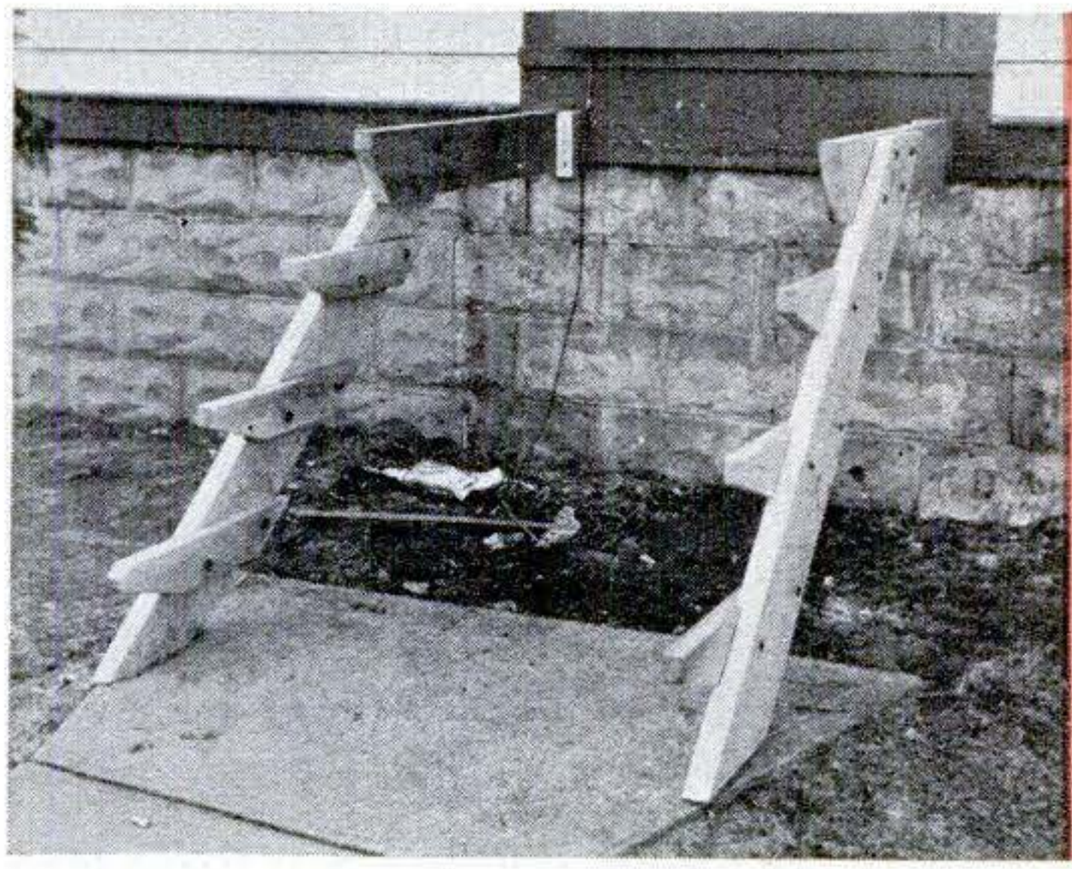


ROTTED AND RICKETY steps above were replaced by set at right.

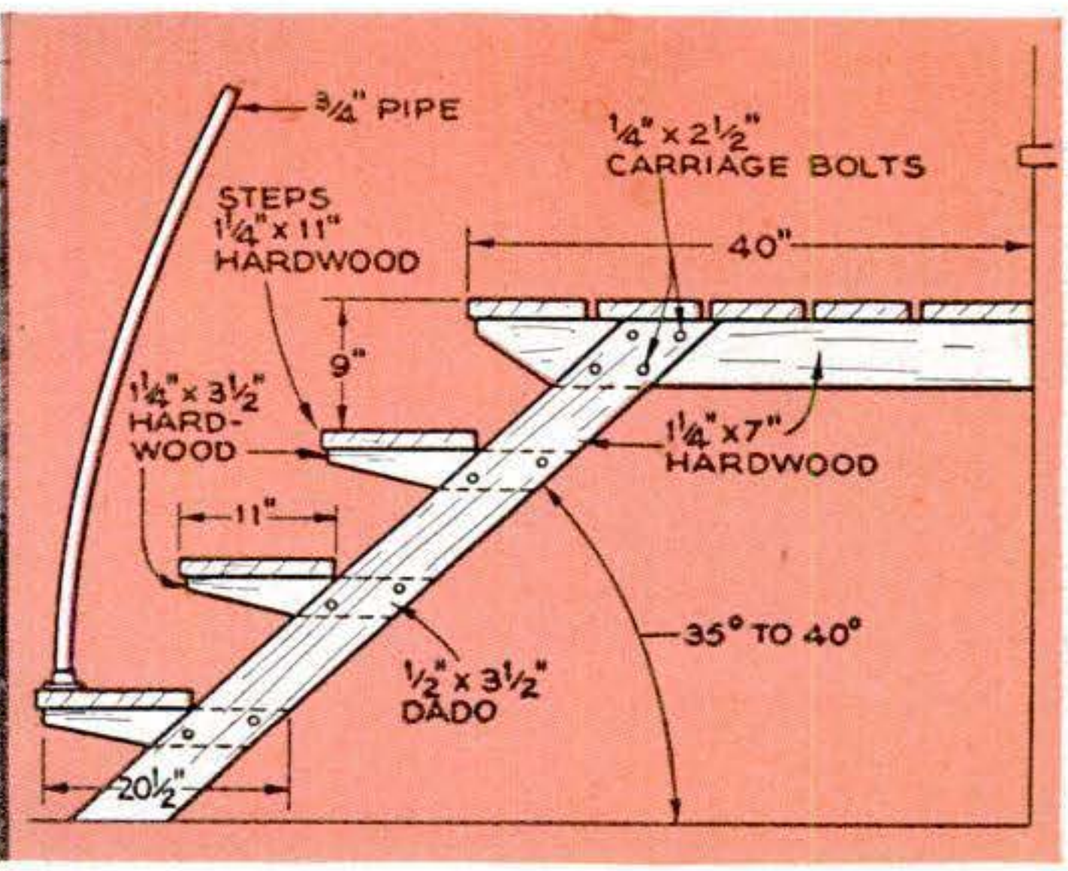


Simple Steps Defy Rot

ONCE your outside steps begin to go, there's not much you can do except replace them. Rot at ground level or in the corners where the treads meet the risers causes deterioration that is difficult—even impractical—to repair. These steps, designed *not* to let water accumulate in their structure will outlast a conventional design, and their construction is much simpler. It is not necessary to lay out and notch the stringers, as dadoes secure the step supports.—*Harold Kelly, Bergenfield, N. J.*



STRINGERS are fastened to blocks screwed to wall. Lower ends rest on concrete or flagstones. Step supports are bolted into dadoes cut in stringer sides to prevent sagging.

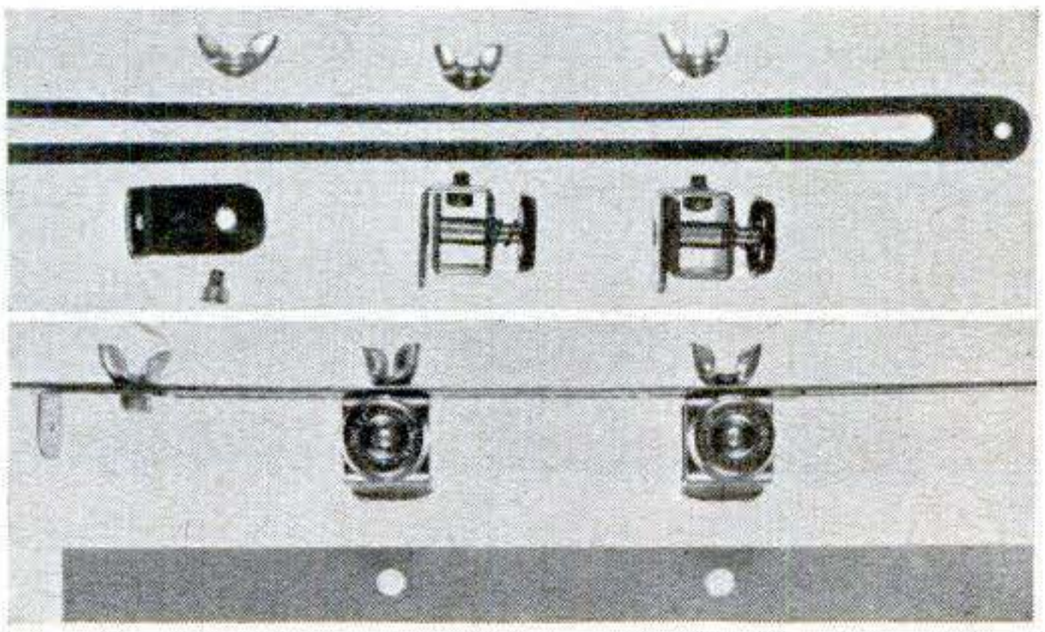


SIDE ELEVATION gives proportional dimensions; height and width are made to suit your doorway. Handrail is 3/4" pipe supported at each end by a cast-iron floor flange.

Adjustable Paper Punch Spaces Holes to Suit Binder

Two or three dime-store hole punches can be set up on a slotter strip of metal (such as a box-lid bracket) to enable you to quickly punch papers to fit in ring binders.

Drill the back of each punch and thread or solder a short machine screw in each hole to serve as a stud. Use wing nuts to clamp the punches to the bracket as shown at right. Attach a small metal angle to one end of the bracket to guide the edge of the paper.—*Andrew Brennan, Philadelphia.*



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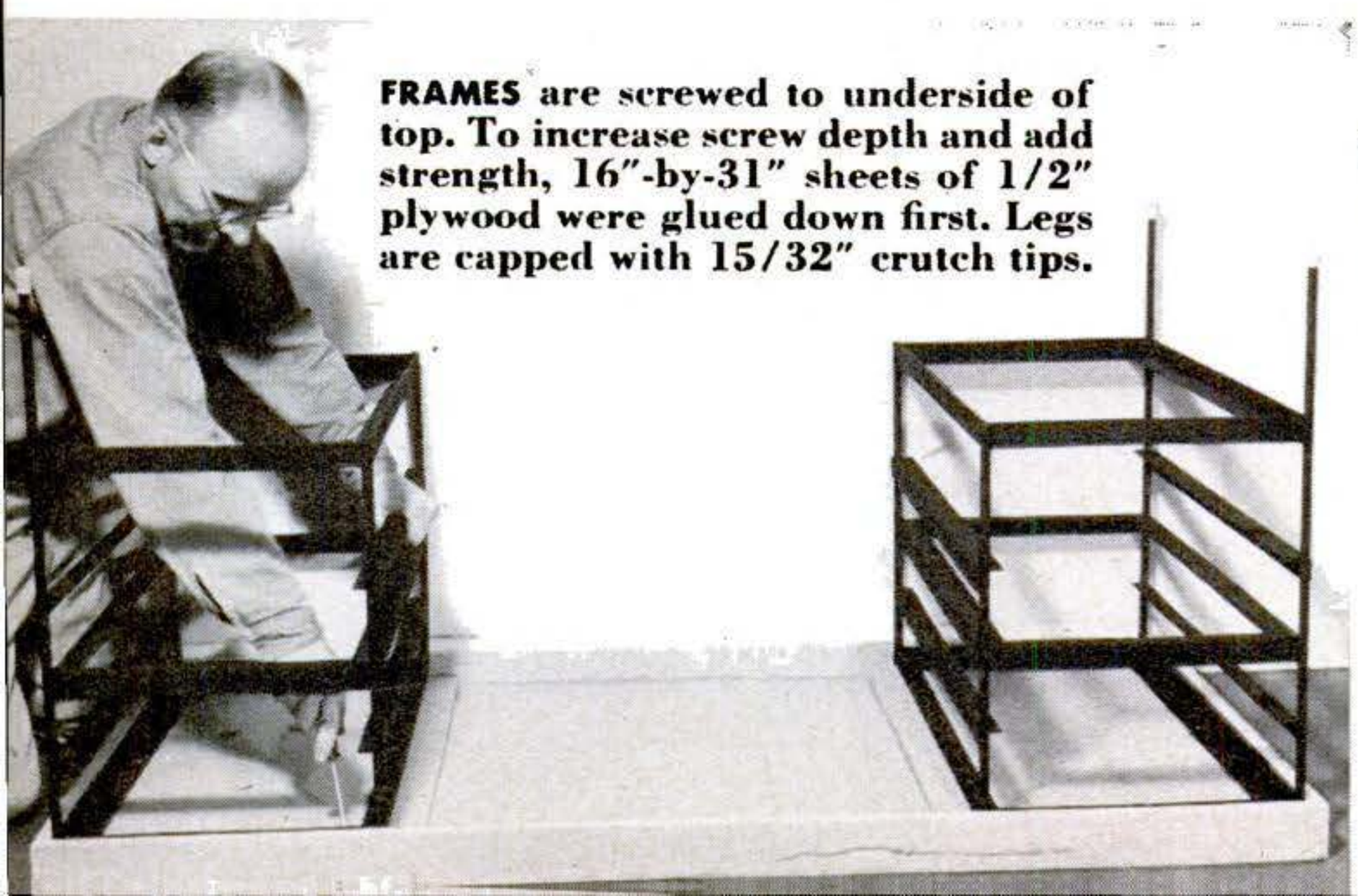
Iron and Plywood

Inexpensive metal frames you can have welded to order support a big working surface and four roomy drawers.

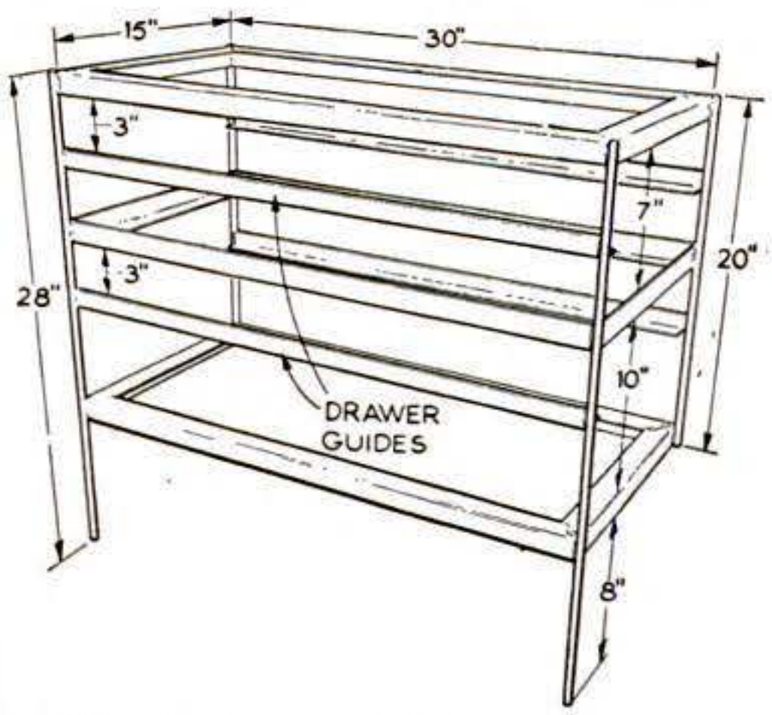
JUST because a desk is meant for working doesn't mean it has to be built like a battleship and look just as frightening. The one I made combines the sleek lines of wrought iron with a sturdy plywood top and drawers.

Painted in bright enamels that contrast with the rich black of the metal, the desk is as pleasant to look at as it is to work at. The iron frames also saved a lot of tricky carpentry on joints and drawer slides.

Making the frames. Each leg-and-drawer frame consists of three 15″-by-30″ rectangles made from 1″-by-1″-by-⅛″ angle iron. These were joined at the corners by four ½″ metal rods. The two inner rods are the height of the drawer sections, while the outer two are full length for legs.



FRAMES are screwed to underside of top. To increase screw depth and add strength, 16″-by-31″ sheets of 1/2″ plywood were glued down first. Legs are capped with 15/32″ crutch tips.



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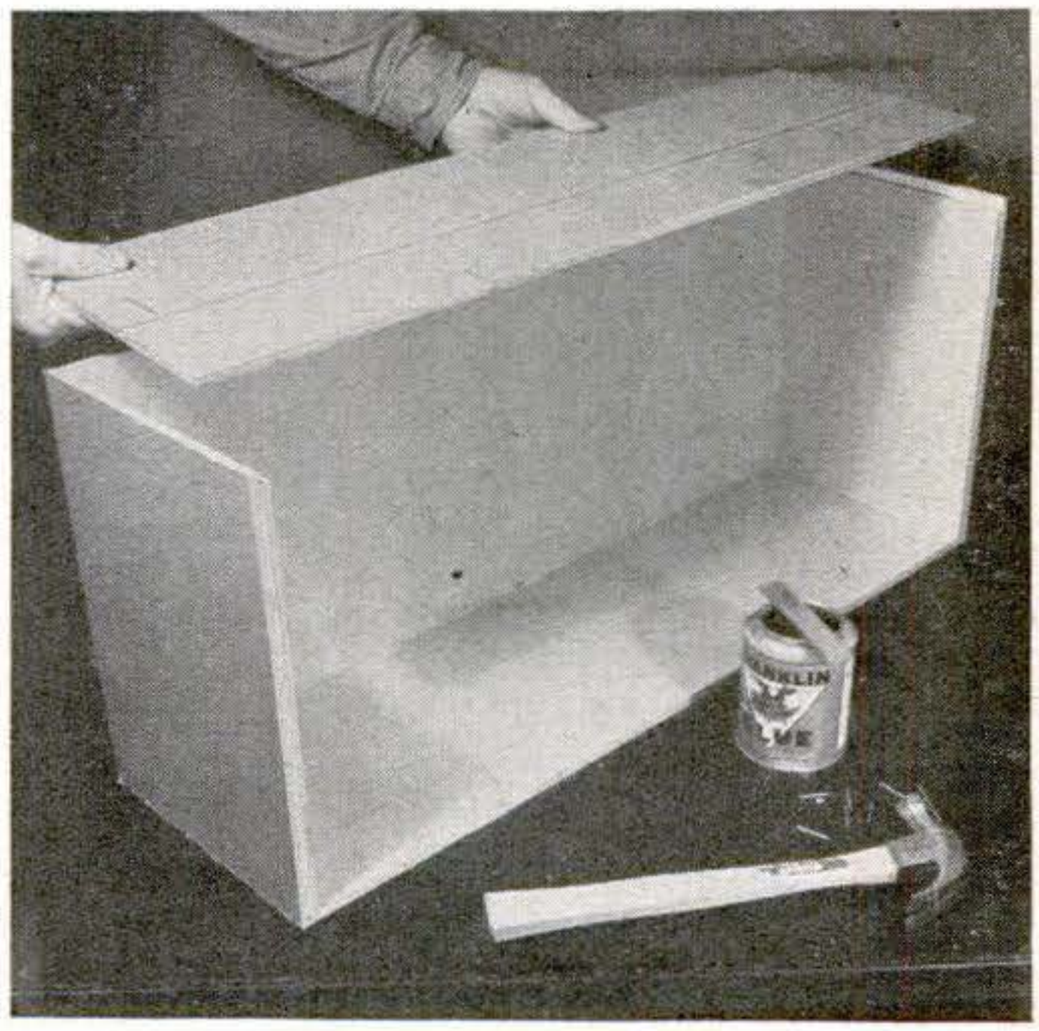
Build Sturdy Modern Desk

To hold the drawers, extra 30″ lengths of angle iron were added to the sides of each frame 3″ down from the upper two rectangles. Grooves cut in the sides of the drawers slide on the angle irons, so that they serve as both supports and guides.

I had a local welder make up both frames for me for about $30. If you can do your own welding, you can probably cut this cost in half or more.

Top looks massive. This is a 32½″-by-60″ piece of ¾″ plywood, edged with a 2″ strip nailed and glued to the underside all around. The edging gives it the appearance of a thick, solid top at a fraction of the weight and cost. I used a plastic-faced plywood, made especially for painting. This costs a little more than regular plywood, but produces a really slick finish.

The 13½″-by-30″ drawers are also plywood. The top two are 6½″ deep and the bottom two 9¾″ deep. They're assembled and grooved as shown in the photo.—*Paul Corey, Sonoma, Calif.*



DRAWERS are ½″ plywood for ends, ¼″ plywood for sides and bottom. Front and back have ¼″ rabbet into which sides and bottom are glued and screwed. Grooves on sides to take drawer guides are 3/16″ wide, ⅛″ deep and 2⅞″ down from top. Drawers are painted green flat enamel, top red, frames black.

in AUGUST

for heat exhaustion. Caused by heat from sun or weather or boiler rooms, it's different from sunstroke, caused directly by sun.

SALT tablets will help prevent heat exhaustion. So will salt swallowed in water. So will loose clothing, drinking fruit juices, and avoiding alcohol. **Symptoms of heat exhaustion are cold skin, pale face, sweating, fainting, sighing, cramps and high temperature. Lay a victim flat on his back, keep his head low, and keep him warm. Loosen clothing and give him hot coffee, or aromatic spirits of ammonia. Give him salt in water. A victim of sunstroke has a dry, hot skin; a red face and fever. Put cold cloths on his head, and give him cool water but no coffee or stimulants. For either heat exhaustion or sunstroke, call a doctor at once.**

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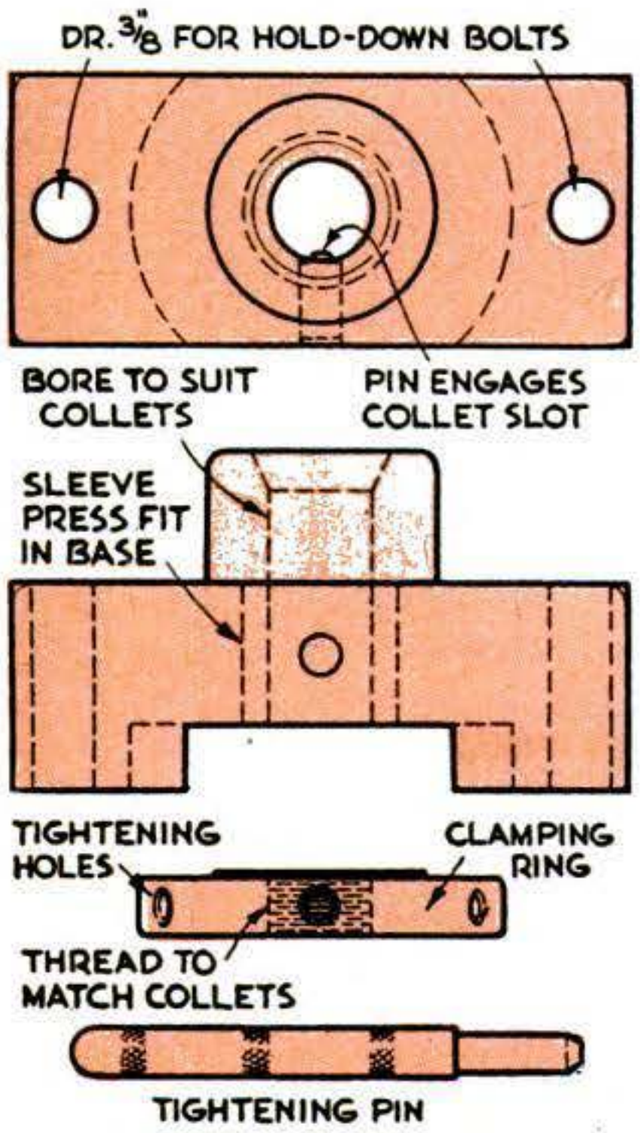
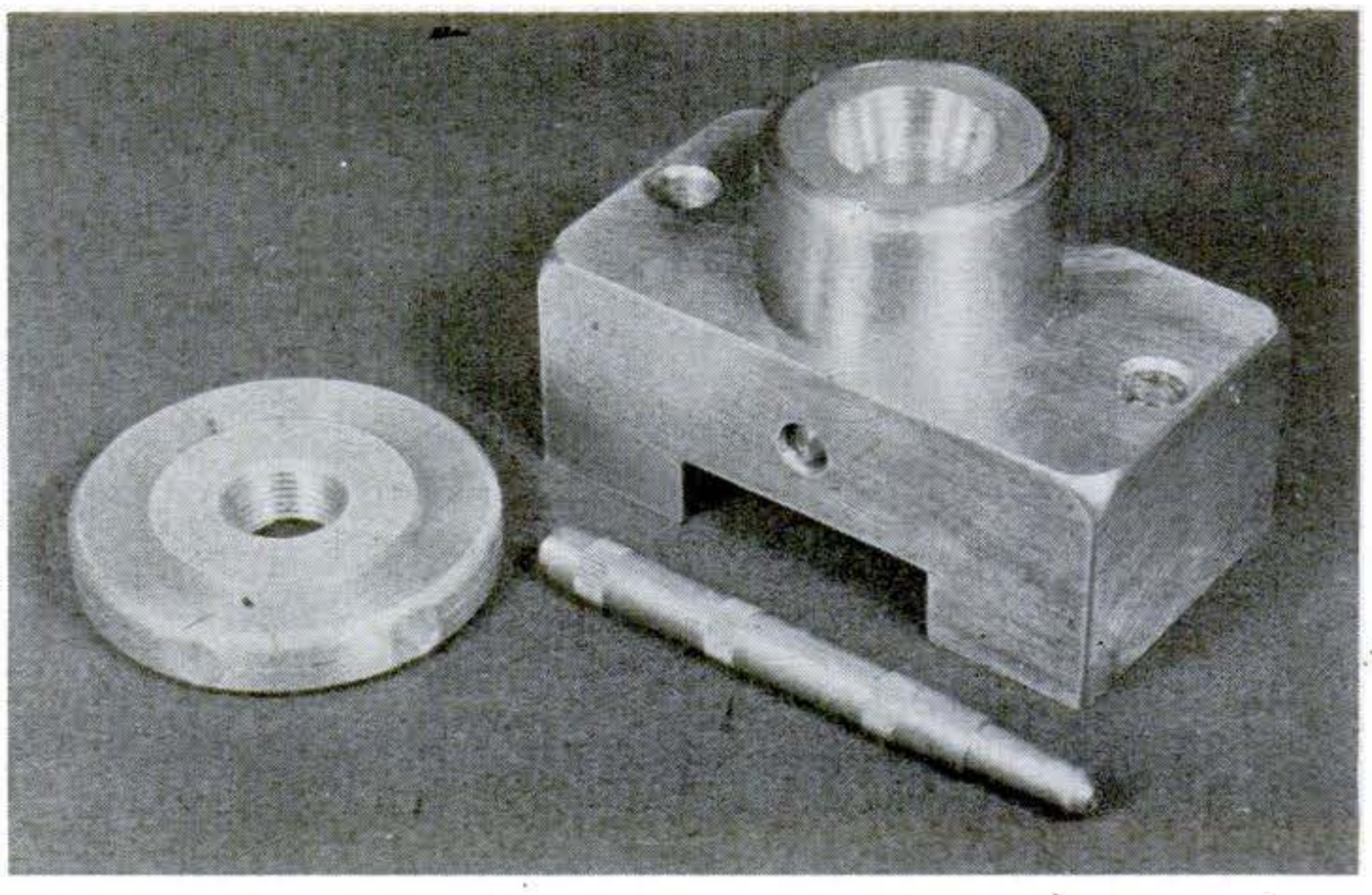
NEW Shop Ideas

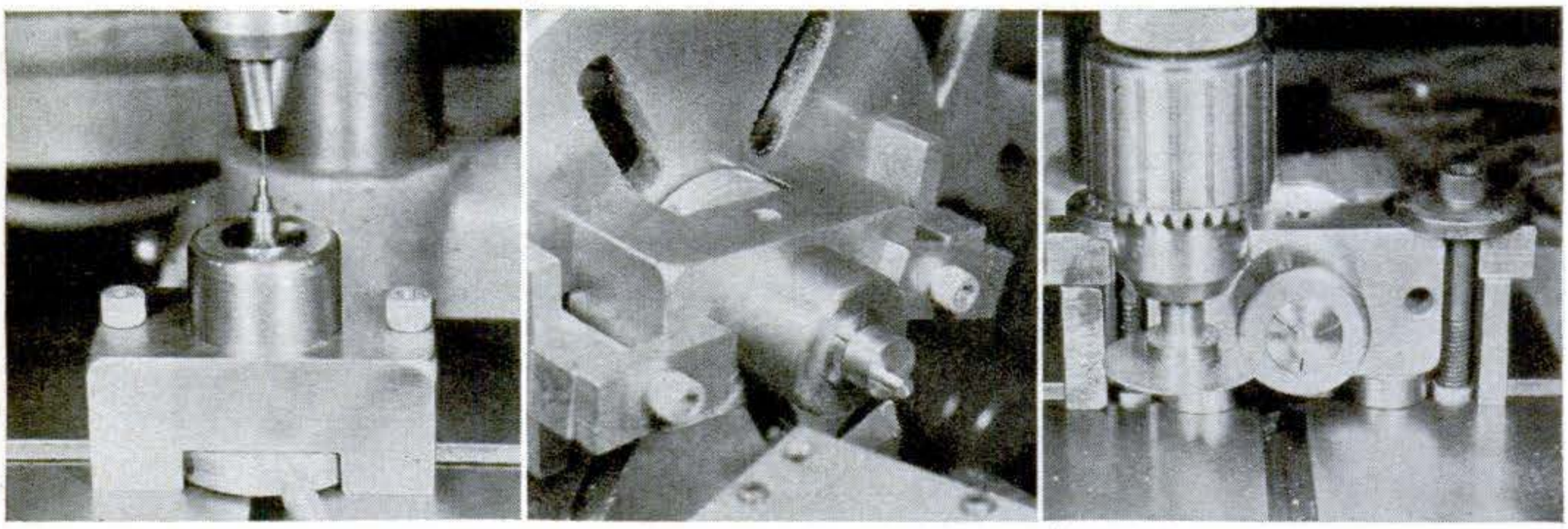


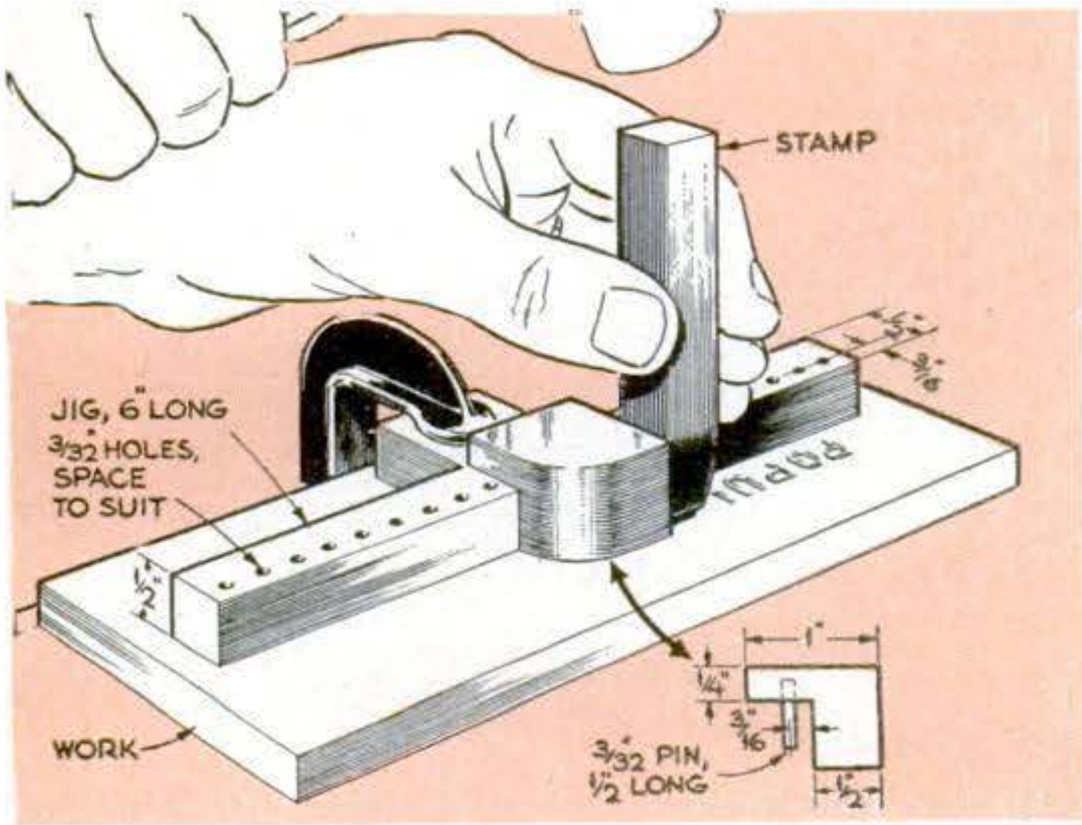


Extra Duty for Collets. This collet block will bring those collets out of quiet retirement on the rack behind the lathe and put them back to work.

Shown below are three uses to which the block adapts them: left, as an auxiliary vise for the drill press; center, clamped to the lathe face plate for turning eccentric jobs; right, holding stock for milling or slotting operations.

The block consists of a base, squared on all sides, that supports an internally tapered sleeve bored to receive the collets. The collets are drawn tight on the work by a clamping ring threaded to fit the collet threads. A tightening pin fits into holes drilled around the clamping ring to turn it on the collet threads.—*J. C. Magee, Schenectady, N. Y.*





Jig Guides Letter Stamps. If your metal-stamping jobs resemble a schoolboy's printing, you'll find good use for this jig that keeps the letters in line and spaces them out evenly.

The body of the jig is cut from ½" steel, and the front edge filed straight. The spacer block is fitted with a steel pin that is moved progressively along the row of holes drilled in the body to set off the spacing of the letters. The corner formed by the spacer block and jig body positions each letter accurately.—*Pvt. Philip McCafferty, Fort Bliss, Tex.*

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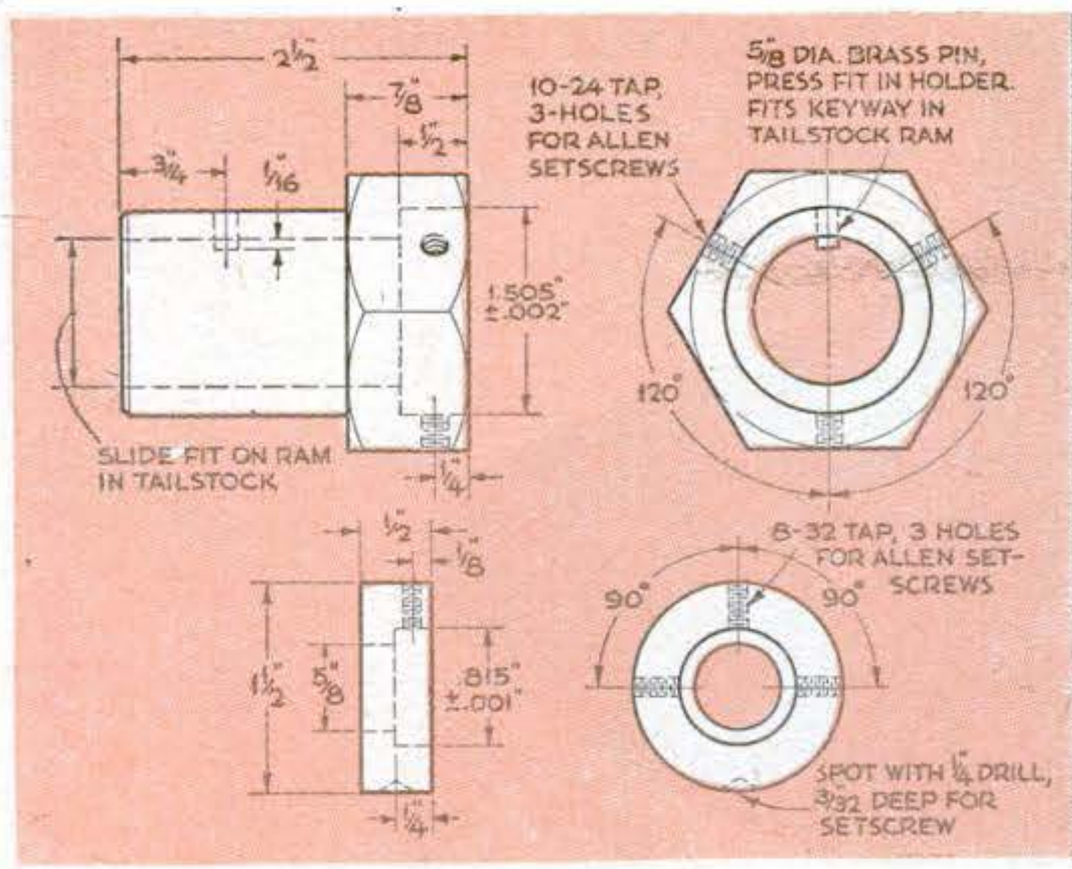
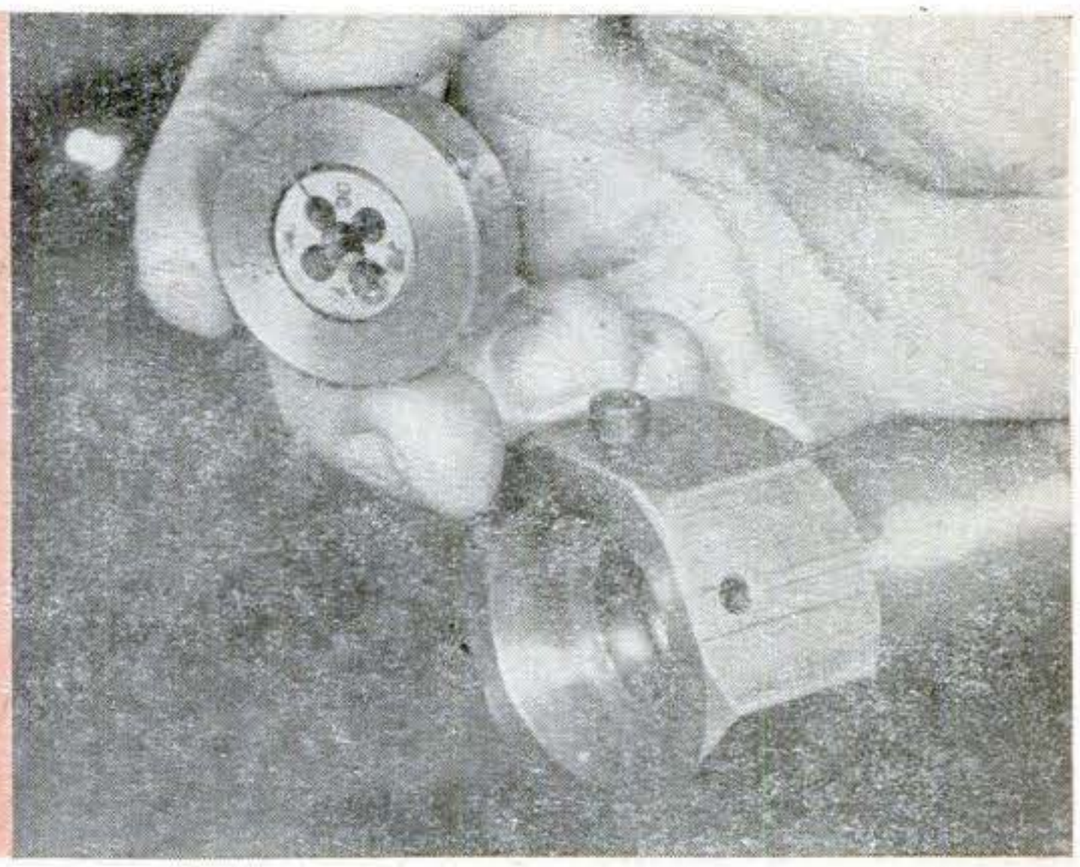
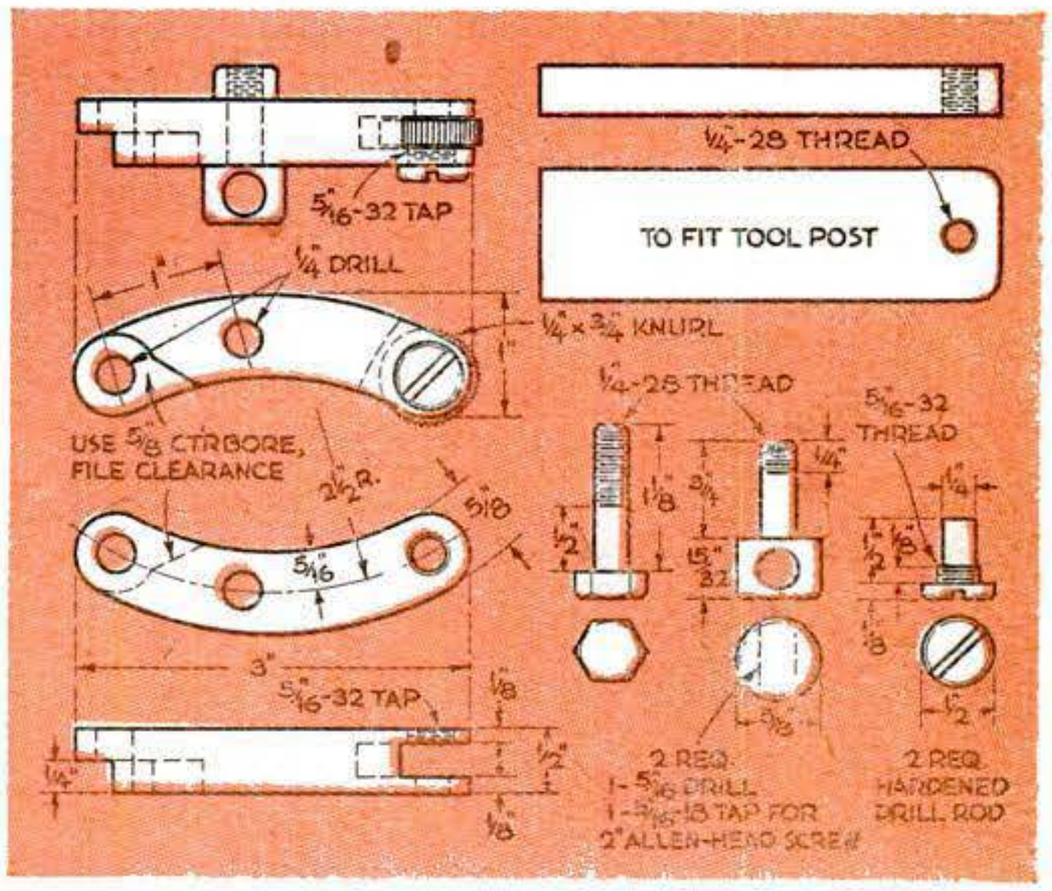
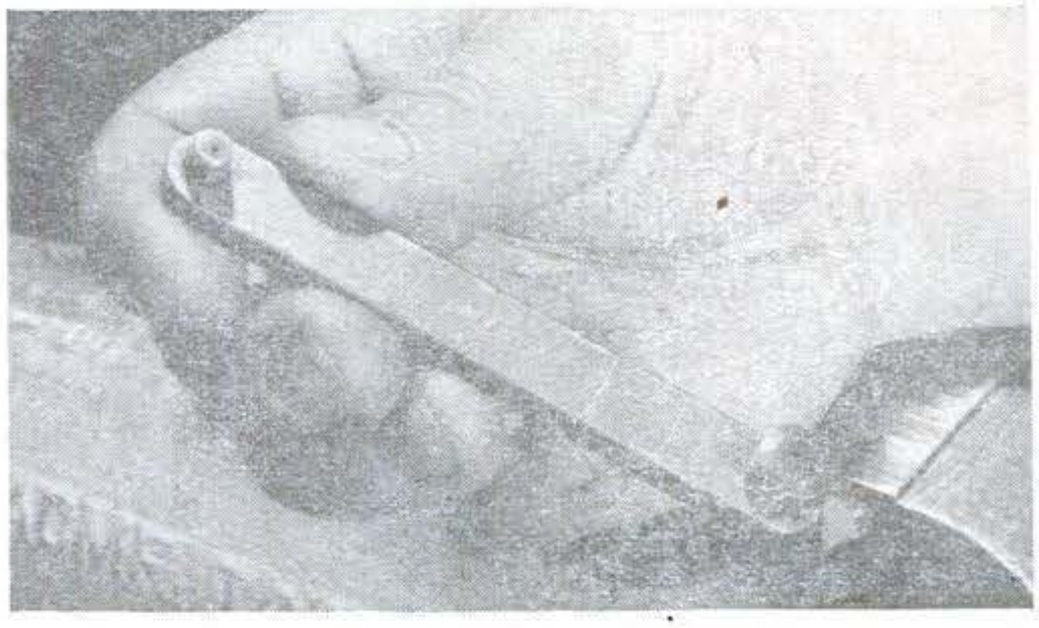




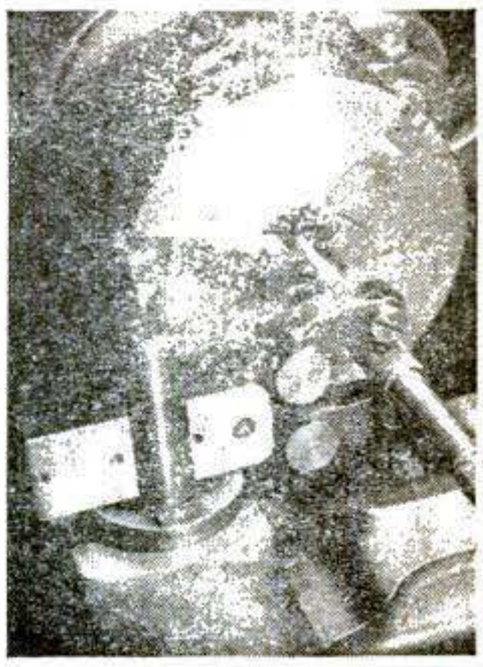
Tailstock Die Holder. You can speed up your threading jobs with this die holder, and forget about resetting dies. Each die is set once and locked in a round collar that fits into the die holder. The holder also permits longer threads to be cut, as it fits over the tailstock ram, not inside. This means that the work can pass through the die to the full length of the ram. Made a sliding fit on the ram, the holder is kept from turning by a pin that rides in the ram keyway. This pin also acts as a safety, as it will shear off if the die runs up against the chuck or a shoulder on the work.

Emergency Live Center. Faced with a super-accurate job to set up between centers and a live center that's worn or scored, you can save the day and do the job by chucking a piece of cold-rolled rod in the three-jaw chuck and turning a 60° point on it. Set up the job without disturbing the newly turned center, for it will not be accurate once removed from the chuck. The lathe dog can be driven by one of the chuck jaws. —*Joseph Tracy, New York City.*





Double-Ended Allen Wrench. Both screws and nuts can be tightened with this little homemade tool. One end is fitted with a short length of hexagon rod and works like an Allen wrench; the other end is fitted with an Allen-head screw with a hex opening the same size as the hex rod. This tightens nuts like a socket wrench. Either end can work in tight spaces. The size should be stamped in the center of the steel strip.



Knurling Tool Saves Lathe Bearing. This knurling tool squeezes itself on the work without producing the excessive side thrust on the headstock bearing that an ordinary knurler does. Adjusting the Allen-head screw on the side of the tool forces the knurls together above and below the work. After a few passes, the Allen screw is tightened to deepen the cut. The tool can be used with either straight or diamond-pattern knurls.—*Floyd McGuckin, Ridgewood, N. J.*

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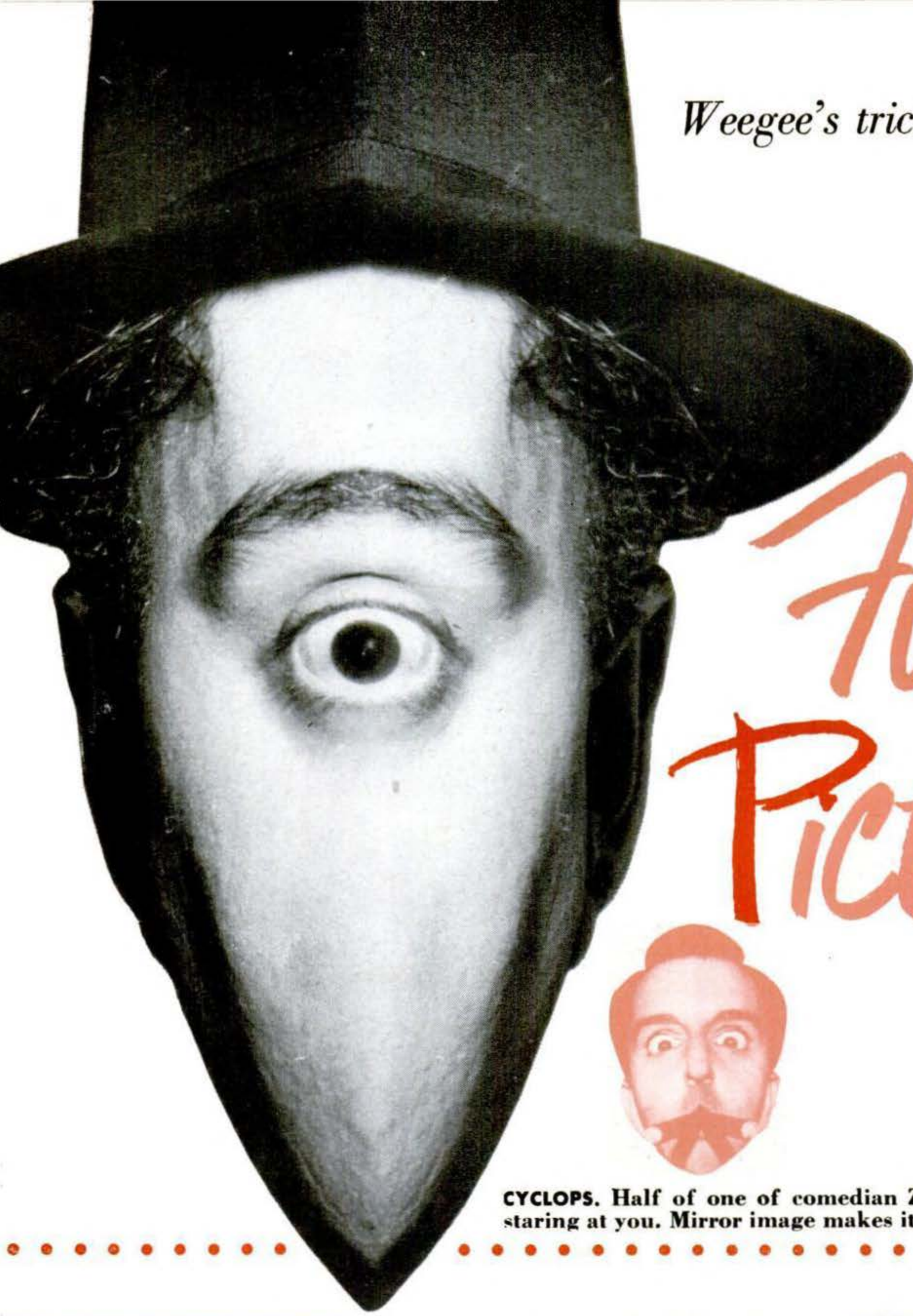
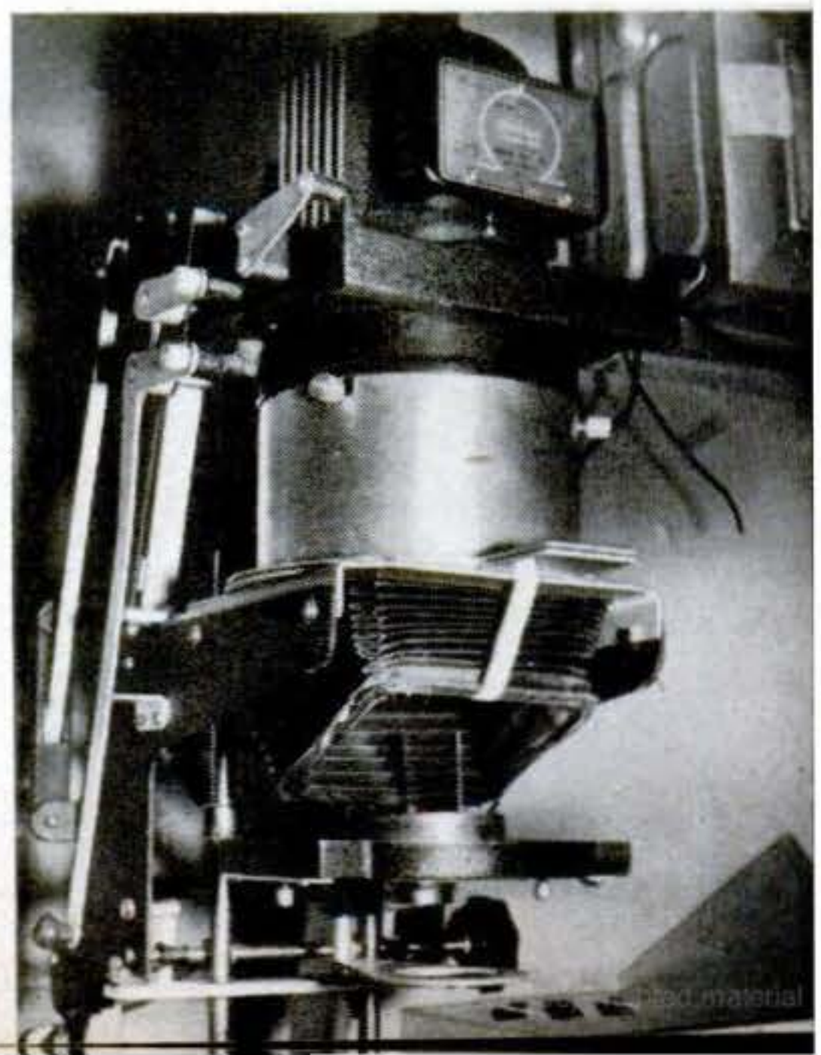
Weegee's tricks with pix

Funny Pictures



CYCLOPS. Half of one of comedian Zero Mostel's eyes is staring at you. Mirror image makes it look like whole eye.

How mirror photos are made. A metal shaving mirror mounted to tilt inside a brass ring does the trick. For the mount, Weegee used a slice cut from large pipe nipple, but a plywood ring would be just as good. Set-screws hold mirror in two lengths of rod split at the ends. To use the unit, Weegee removes the enlarger lens board, rests unit above the lens and locks board back in place. Bellows is loosened from lens-board mount (right) and held up with tape to show the setup. It's a good idea to rest metal mount on a cardboard ring to keep metal from marring the lens. Different effects are obtained by revolving the negative carrier.



give us a new slant on some familiar faces.

By R. P. Stevenson

THE curious pictures on these and the next two pages came into being because a photographer accidentally gave himself a hot mitt, manual counterpart of the hot foot.

The photographer was Arthur Fellig—Weegee to New York and Hollywood pals and readers of his books. The hot mitt occurred when he triggered juice into a big flash bulb without first letting go of it. Unable to manage a camera until his baked hand cured, he whiled away his time doing one-handed tricks with an enlarger.

Drawing on a huge file of negatives of the famous and almost so, Weegee soon was making two heads grow where only one grew before, turning pinheads into bulgedomes and bulgedomes into pinheads, and pleasing certain mamas by switching an only child into photographic twins.

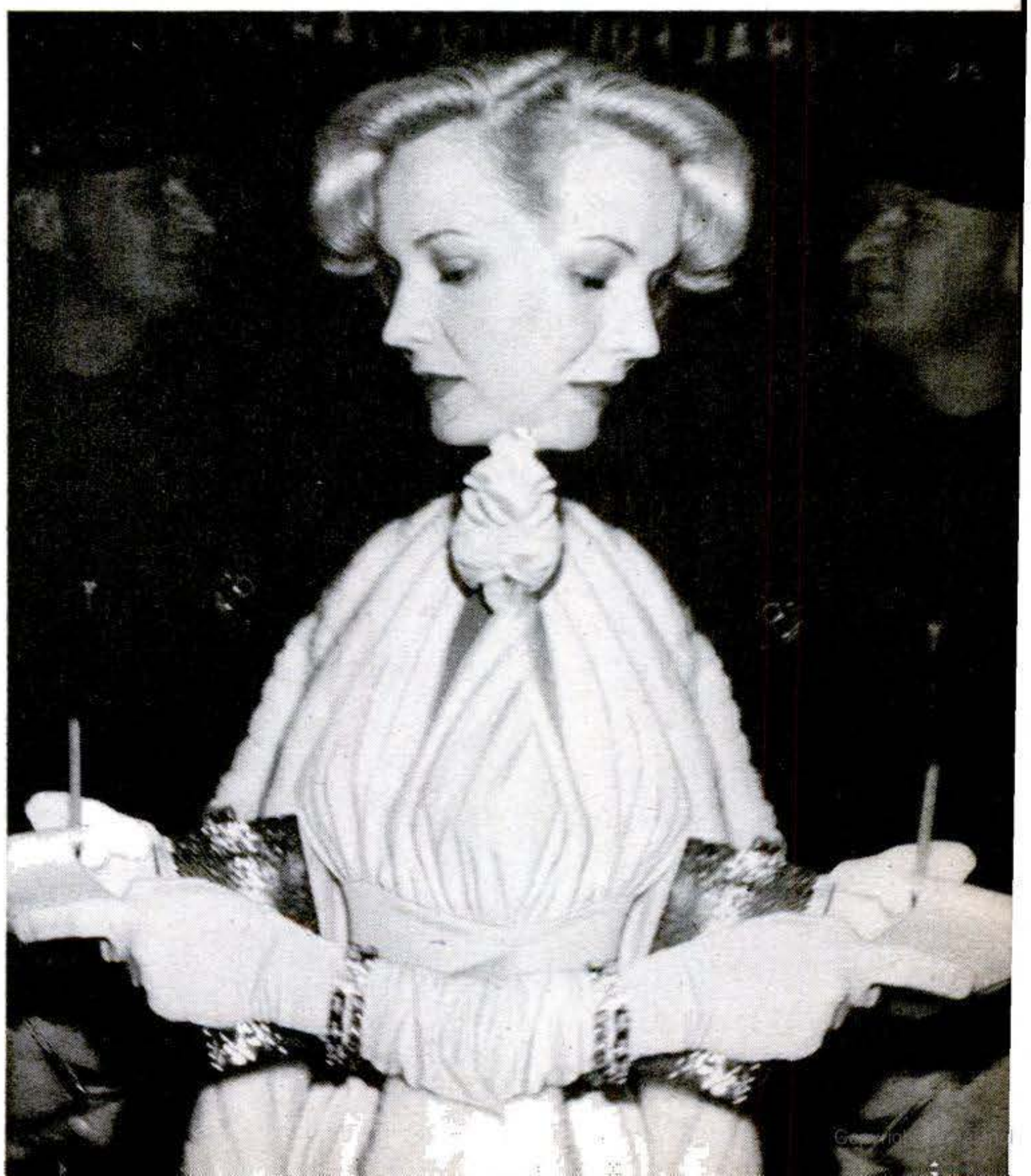
The equipment for this new darkroom sport was simplicity itself. All that's required is a front-surface mirror held vertically inside the enlarger bellows between the lens and the negative carrier. Weegee uses a metal shaving mirror, cut down and mounted on pivots inside a brass ring.

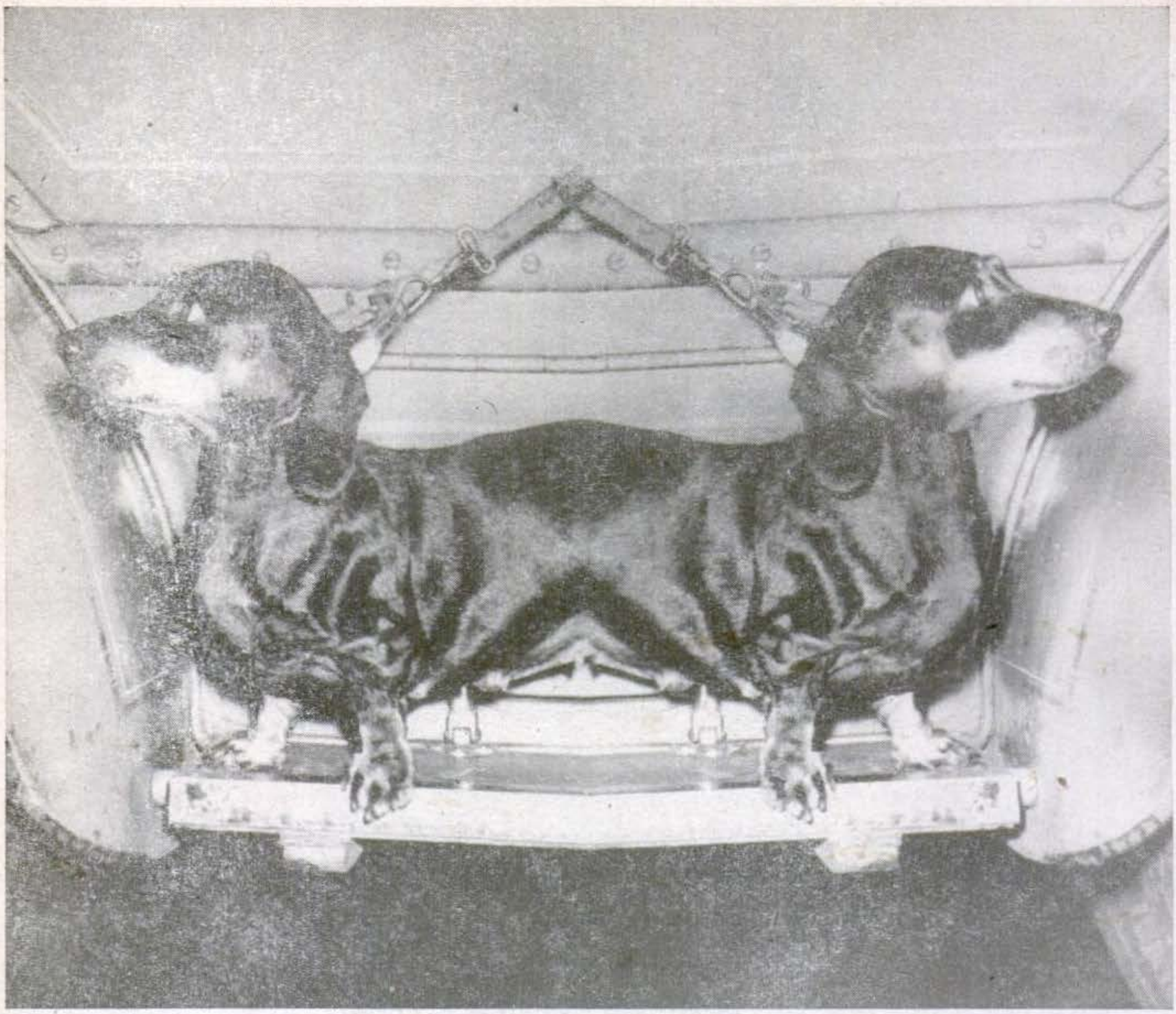
Originally a New York press photographer, Weegee has been doing special photographic effects for Hollywood movies in recent years. His books include *Naked City*, *Weegee's People* and *Naked Hollywood*.

Please turn page for more funny photos.

Made with Mirrors

"IT'S SO CONFUSING," said actress Virginia Mayo when Weegee showed her this two-faced picture. But her studio liked it, and it was published in Los Angeles newspaper.





A DOG'S LIFE becomes really tough when two heads have not a single tail to chase. If this man Weegee keeps up this sort of thing, canines may acquire split personalities.

ETERNAL TRIANGLE on dance floor shows just half of the woman and the man twice, a situation some would consider unfair. It could as easily have been two women and one man.

QUADS are easy to have if you start with twins. Adding a mirror image to a straight photo of the twins in a carriage made one plus one equal four.

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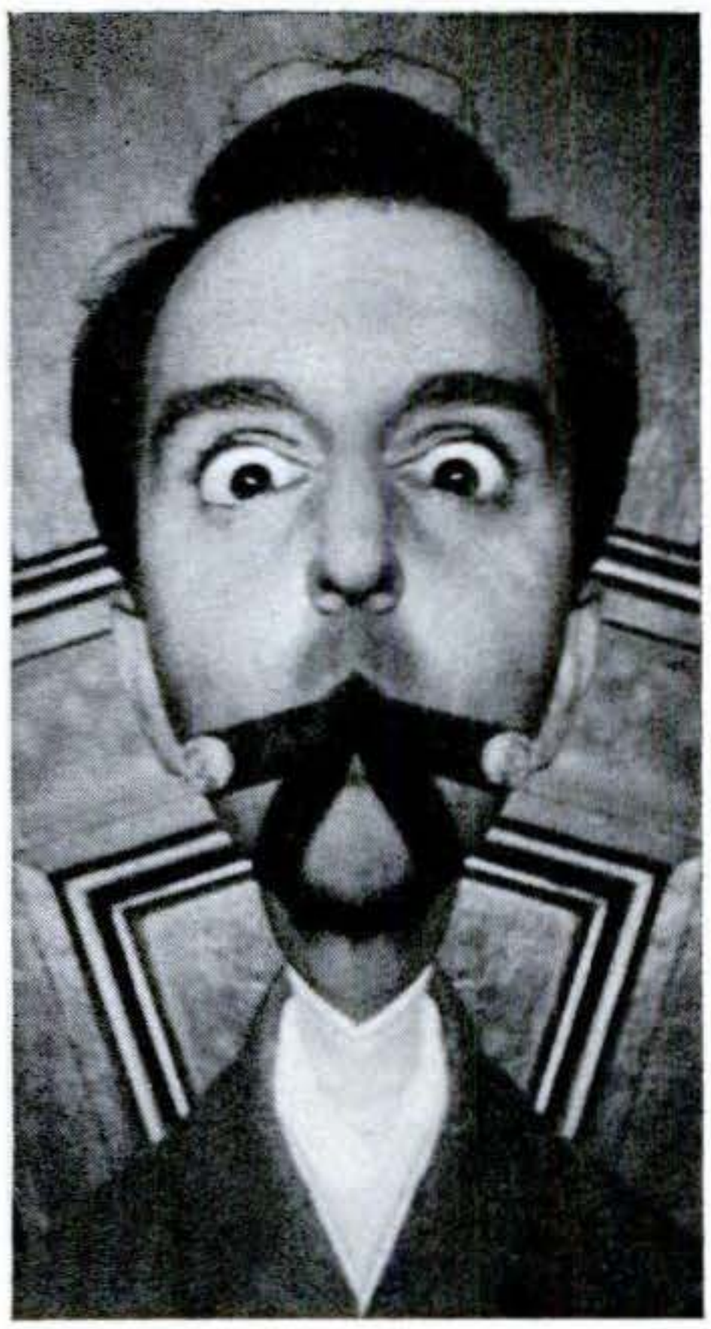
PINHEAD shape was given to Tony Martin's face by using a ¾ view of the singer, splitting it vertically.



BULGEDOME. Tilting the mirror to the left across Danny Thomas' face gives the effect above.

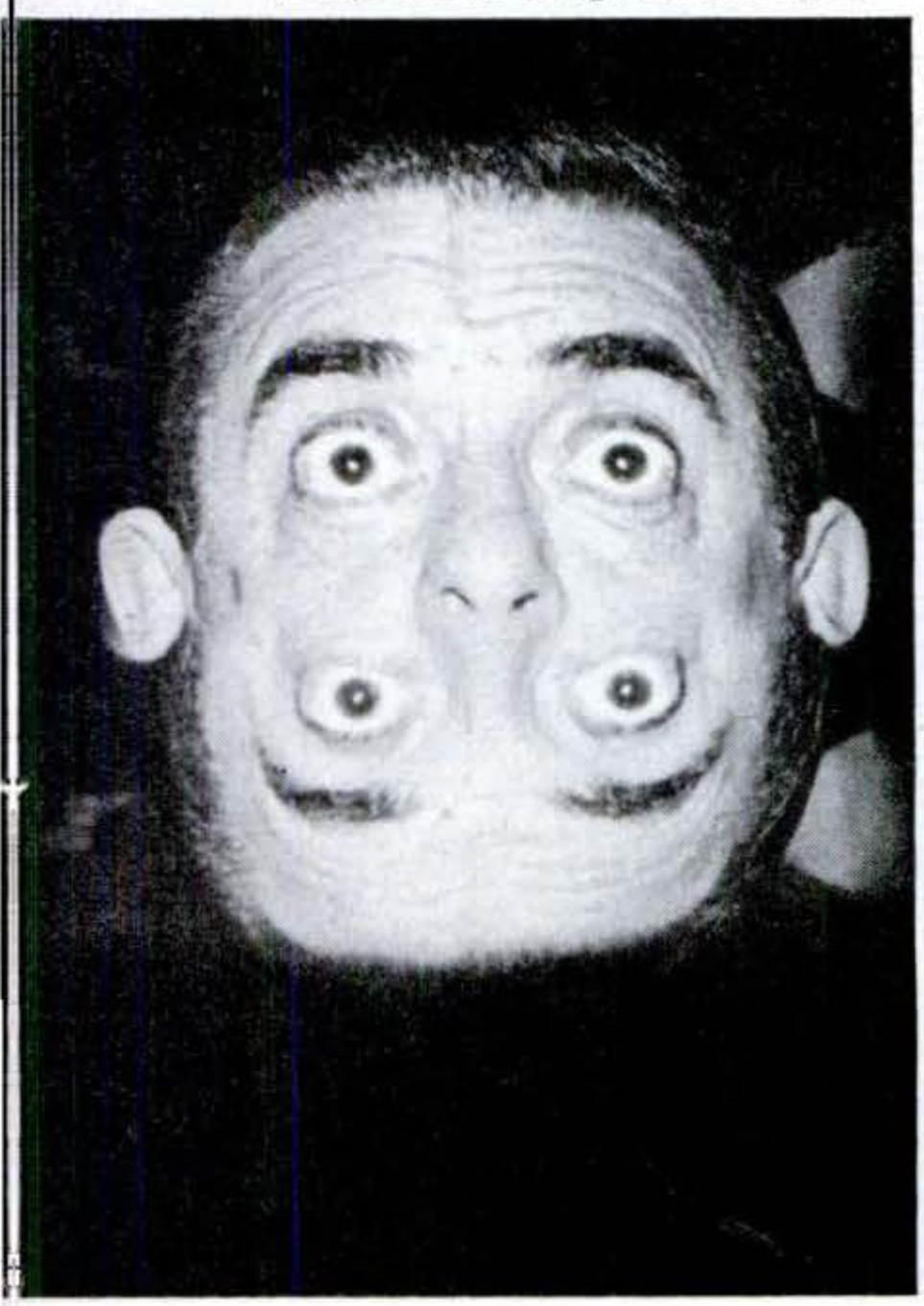
ROCK-JAWED character here is also Danny Thomas, but the mirror that did it was tilted to the right.

Caricatures are a sound use for Weegee's mirror-enlarger technique. As in artist's caricatures, object is to exaggerate a physical characteristic.

POPEYES are Eddie Cantor's prominent feature, so Weegee turned the mirror crosswise, doubled up on the eyes.

DIAMOND-SHAPED face is that of Groucho Marx. This is a ¾ view like the photo at left above.

CHINLESS WONDER below is Jerry Lewis. Shadow across his jaw gives sunken effect to lower part of face. END



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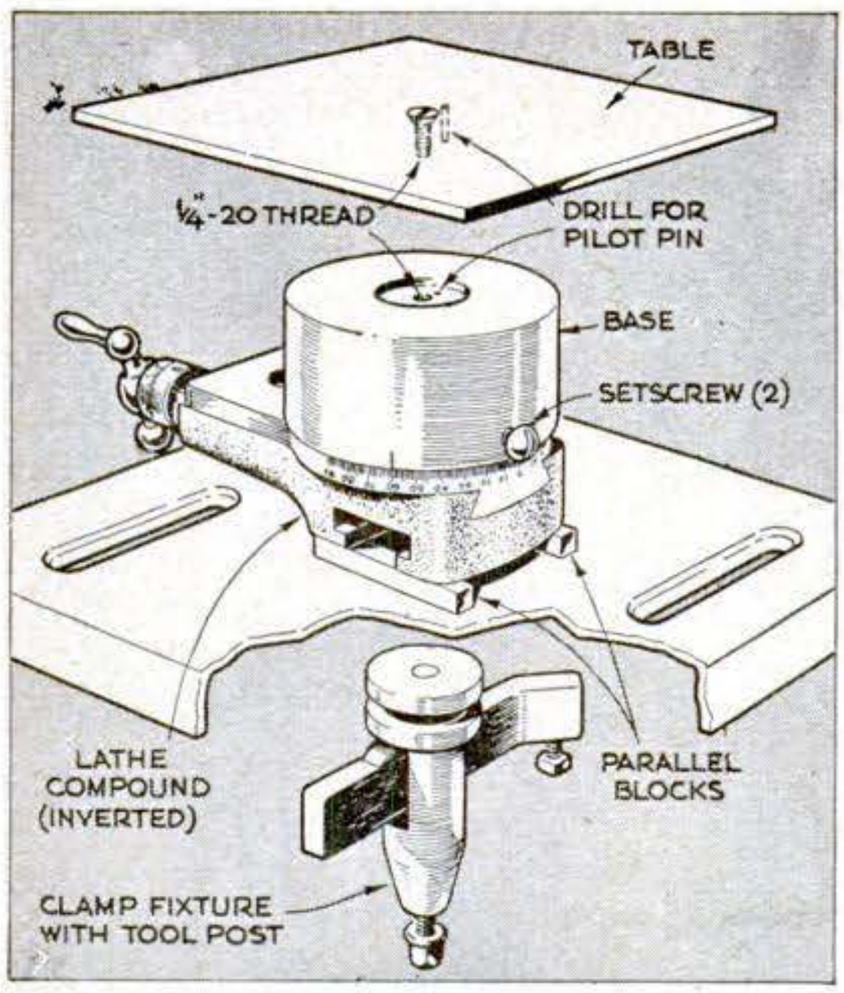
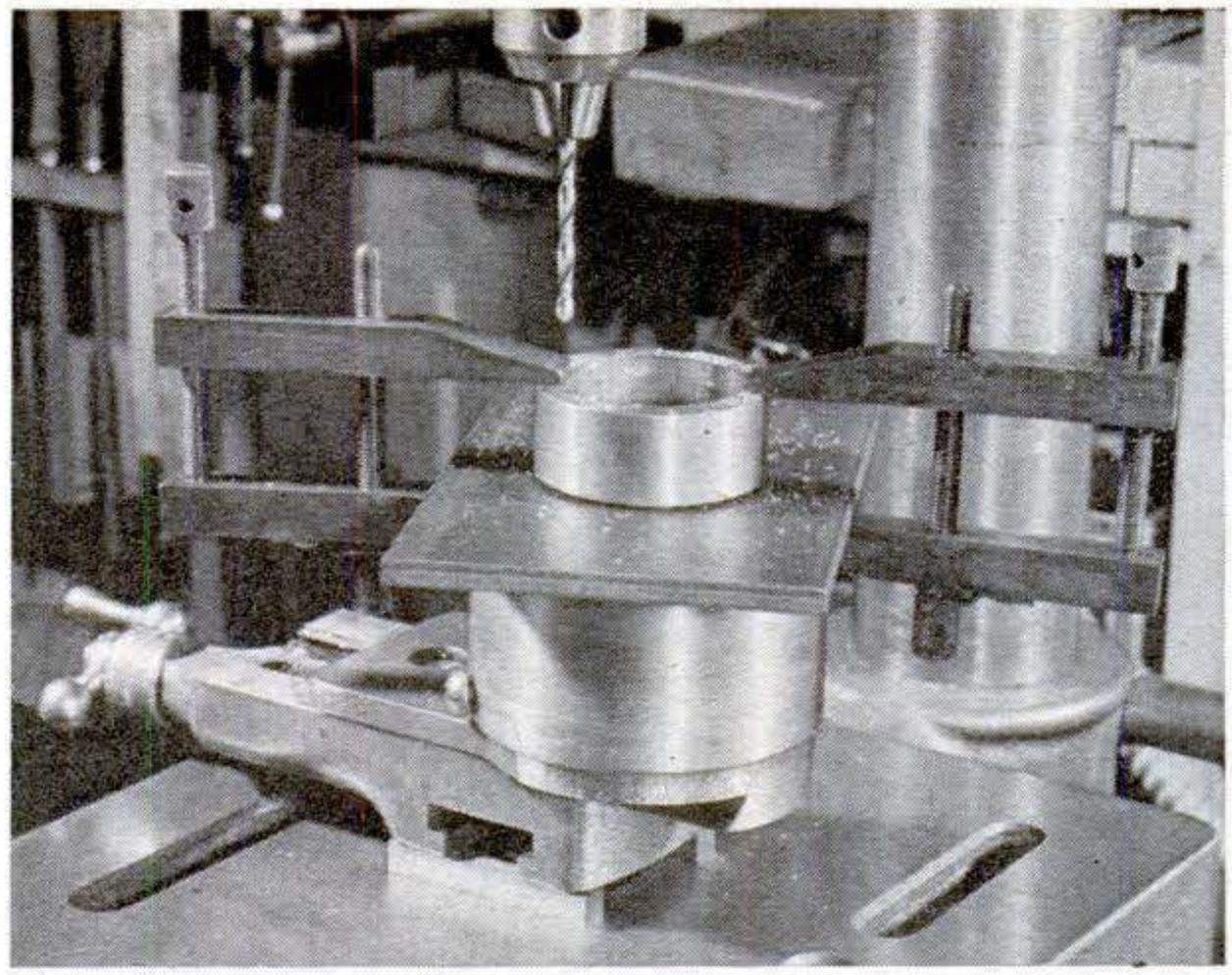




A drill press can locate holes with great accuracy if you lend it part of your lathe.

Lathe Compound

Doubles as Drilling Fixture

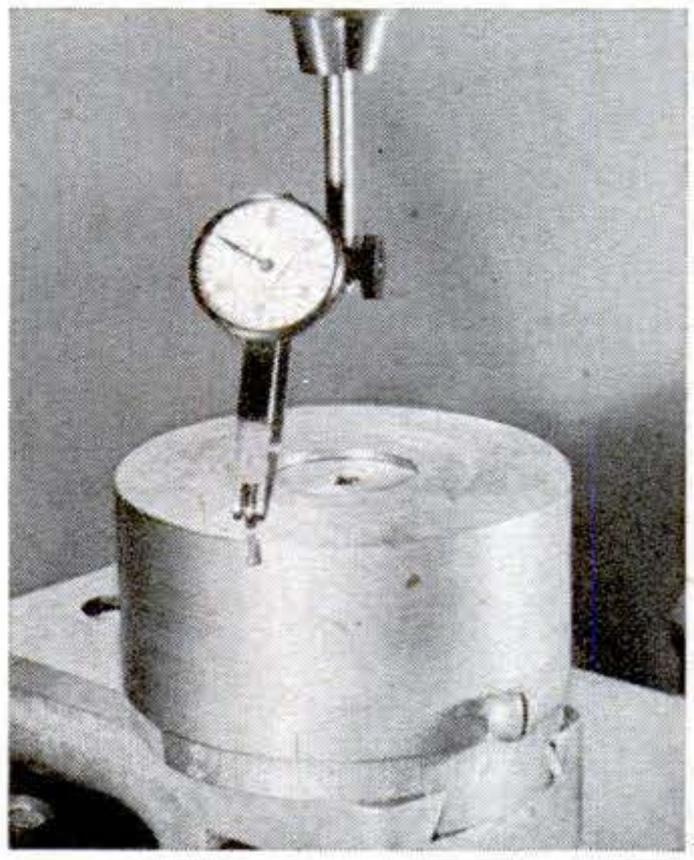
PUT the compound rest from your lathe on the drill press, and you can spot holes to a thousandth of an inch, or to one degree around a circle. The feed collar gauges in-line spacing, the indexed ring angular spacing.

Work base and table. Face a short piece of heavy round stock, turn the edge true and reverse in the chuck. On the other end turn a tapered stud or bore a recess to duplicate the compound mounting on the cross slide. Scribe marks 180° apart for reference with the compound graduations. If yours are on the cross slide, use the lathe index head to graduate the base.

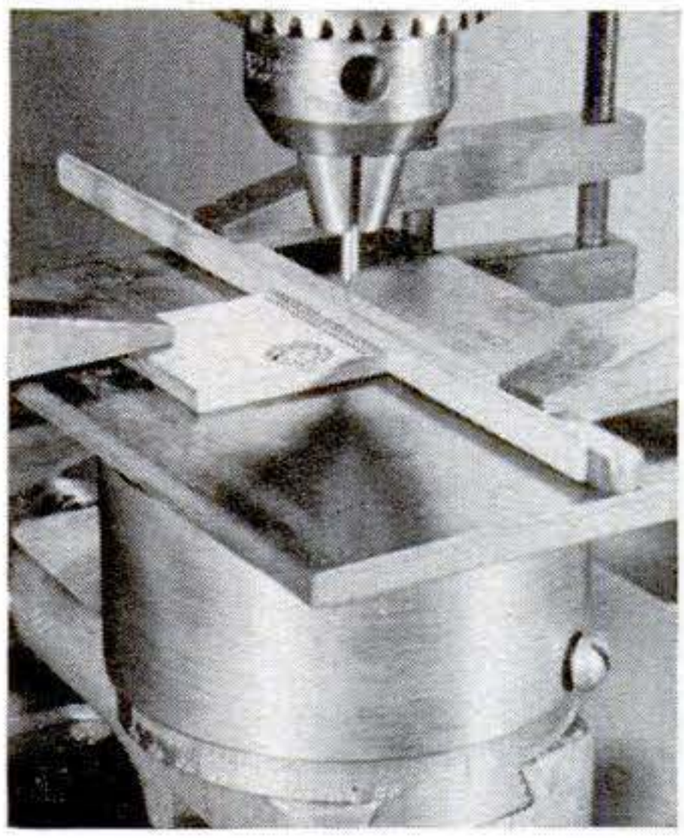
Tap the edge for ¼" clamp screws, if required. Fit on a 4" by 6" table of ¼" brass plate with a center screw and a pilot pin. Put the compound upside down on the drill-press table over two parallel blocks. Clamp it with the lathe tool post through the table hole, tightening it against a tool holder. Then mount the base.

Drilling on a radius. To align the swivel axis of the base with the spindle, chuck a dial indicator in an offset mount (center photo). Shift the compound to show minimum run-out around the base. Mount the table. If the work is round, as in top photo, indicate it true also. Set work to the drilling radius with the compound feed.

Spacing holes in line. Advance the compound fully one way, drill a hole in the table, run it back and drill another. Put pins in the holes. Align a clamped-on fence with them by inserting temporary spacers, which will determine how far holes will be from the edge of the work. Remove pins and spacers, and clamp work so it touches the fence.—*Floyd McGuckin, Ridgewood, N.J.*



TO DRILL ON A CIRCLE, indicate base from spindle as above. If work is round, align it the same way. For in-line holes (below), use a fence clamped parallel to compound travel. Use centerdrill to start holes.



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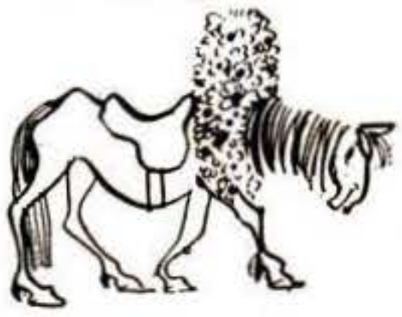
It's the sportsman's movie camera

Lots of fun in a little film

Uses economical 8mm. roll film with easy, no-thread loading. Enough film in each roll to shoot 30-40 average-length movie scenes!

Carries like a dream

Light and compact enough to slip in a jacket pocket—ready at hand when action starts popping. Swings and points as easily as your own 12-gauge.



Telephoto for long shots

An accessory lens magnifies moving targets 3 times to let you come up close on those hard-to-get shots. View finder shows fields for standard or telephoto lens.

Exposure guide works like a charm

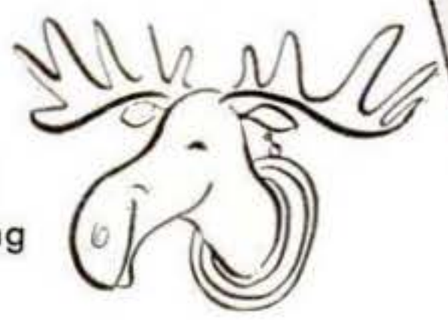
Built-in exposure guide takes out all the figuring, leaves only the fun . . . makes sure exposure's on the button every time!

CINE-KODAK RELIANT CAMERA

With f/2.7 lens, $89.50

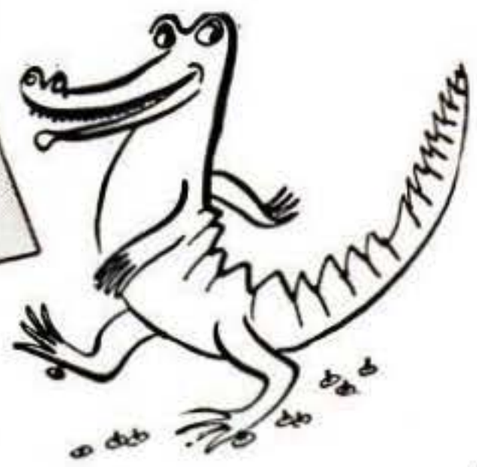
With super-speed f/1.9 lens, $110

Other Kodak movie cameras, from $39.75 . . . at your Kodak dealer's. Prices include Federal Tax and are subject to change without notice.



Stops fast action

Slow-motion setting cuts fast action down to size.
Use it with any film, either lens, for extra-detailed effects.



Movies rain or shine

Your choice of an f/2.7 lens . . . fast enough for cloudy-day shooting . . . or a super-speed f/1.9 job that can see in the rain. Both Lumenized (hard-coated), of course.

Color movies, too

They're easy and inexpensive. Kodachrome movie film costs but $3.95 a roll (8mm.)—*including processing!* (Only $3.25 for black-and-white.)

Tough...rugged

Die-cast aluminum body is built to take it. Your "Reliant" thrives on rough going—yet it's sweet-running as a custom-made reel.

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See "Photographic Equipment and Supplies"

"LET'S MAKE MOVIES"

A free and fascinating booklet that tells how to make color movies . . . how to make movies indoors as well as out . . . how to choose just the right camera for your needs. Just fill out coupon and send to Kodak.

Dept. 6: Please send free copy of "Let's Make Movies" to—

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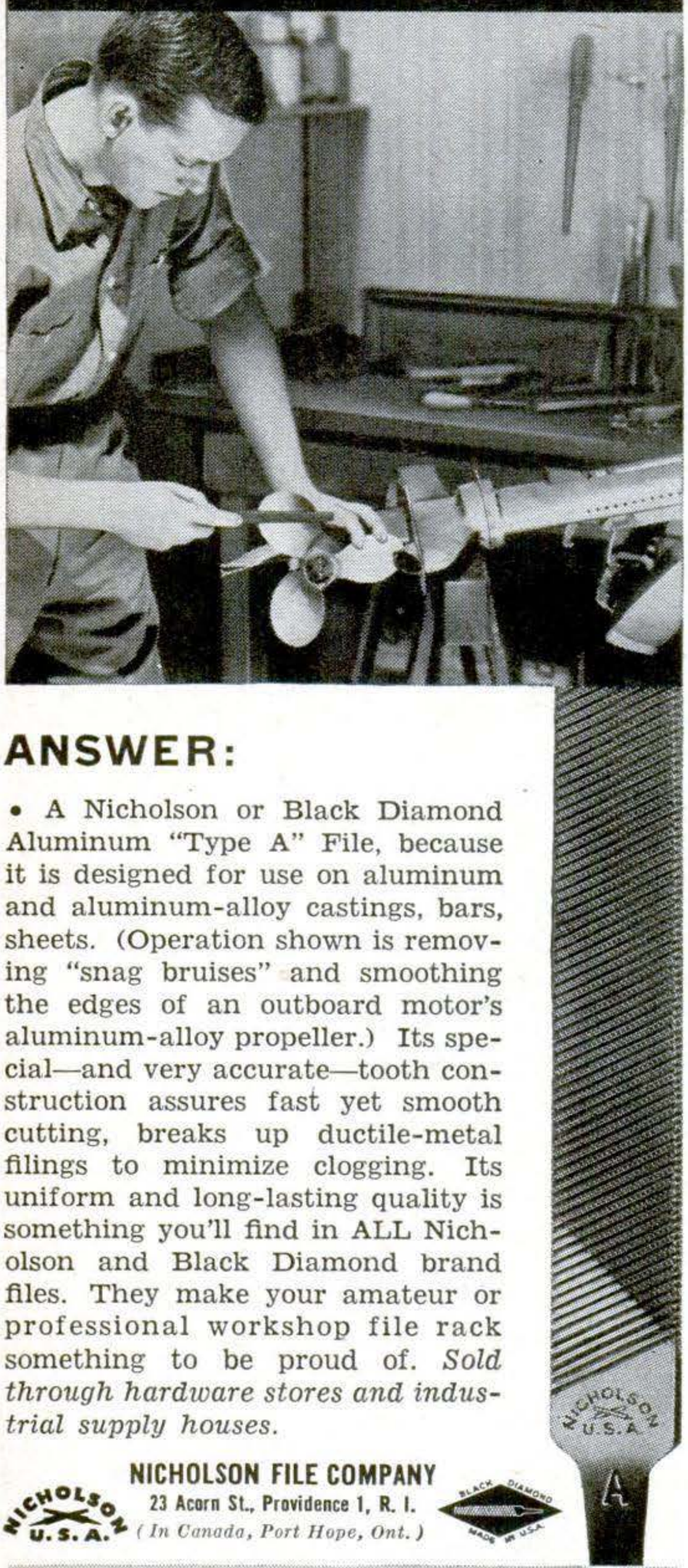
TRADE-MARK

QUESTION:

What's the file for this job?



ANSWER:

• A Nicholson or Black Diamond Aluminum "Type A" File, because it is designed for use on aluminum and aluminum-alloy castings, bars, sheets. (Operation shown is removing "snag bruises" and smoothing the edges of an outboard motor's aluminum-alloy propeller.) Its special—and very accurate—tooth construction assures fast yet smooth cutting, breaks up ductile-metal filings to minimize clogging. Its uniform and long-lasting quality is something you'll find in ALL Nicholson and Black Diamond brand files. They make your amateur or professional workshop file rack something to be proud of. *Sold through hardware stores and industrial supply houses.*

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NICHOLSON FILES *FOR EVERY PURPOSE*

"Squeezed" Movies Challenge 3-Ds

[Continued from page 102]

is a technological novelty, and tackle the job of telling super-realistic film stories.

That is what Twentieth Century-Fox has set out to do in a $4,000,000 wide-screen version of Lloyd C. Douglas' best-selling religious novel, *The Robe*, scheduled for release late this September. This epic of the young Roman legate who wins Christ's blood-stained mantle under the central cross on Golgotha would be a tough assignment for any director, using tried and proven standard-screen techniques. To make full use of wide screen, it becomes a monumental challenge.

Movies on an 80-Foot Screen

Not long ago I saw the results of the first two months of Cinemascope shooting. On a metalized screen which arced some 80 feet across New York City's huge Roxy theater stage, Golgotha came to life again in all its quiet horror. Dark scuds moved sullenly across the sky, and tufts of grass bowed to a wind that swept in fitful gusts from right to left.

They tell me that nearly a thousand workers laid 100,000 board feet of lumber under the 55 tons of dirt used to create that hill; that they blended 300 sacks of casting plaster, 150 bags of cement, 100 sacks of hardwood plaster, 60 tons of sand and 10 bales of fiber to form the bleached outcroppings of rock that fell away to a gigantic backdrop painting of Jerusalem which stretched 650 feet across my line of vision.

Enough Light for 1,200 Homes

They say that the 291 blazing lights which illuminated this $55,000 wide-screen setting drew 35,000 amps—enough to turn on all the bulbs in 1,200 five-room houses, and that the heat produced by this blaze of incandescence would have been intolerable if 1,000 tons of ice hadn't been melted daily in the big air-conditioning units which blew 60,000 cubic feet of cooled air, every minute, across the studio floor.

[Continued on page 212]

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"OLD 16" RIDES AGAIN WITH CHAMPIONS!

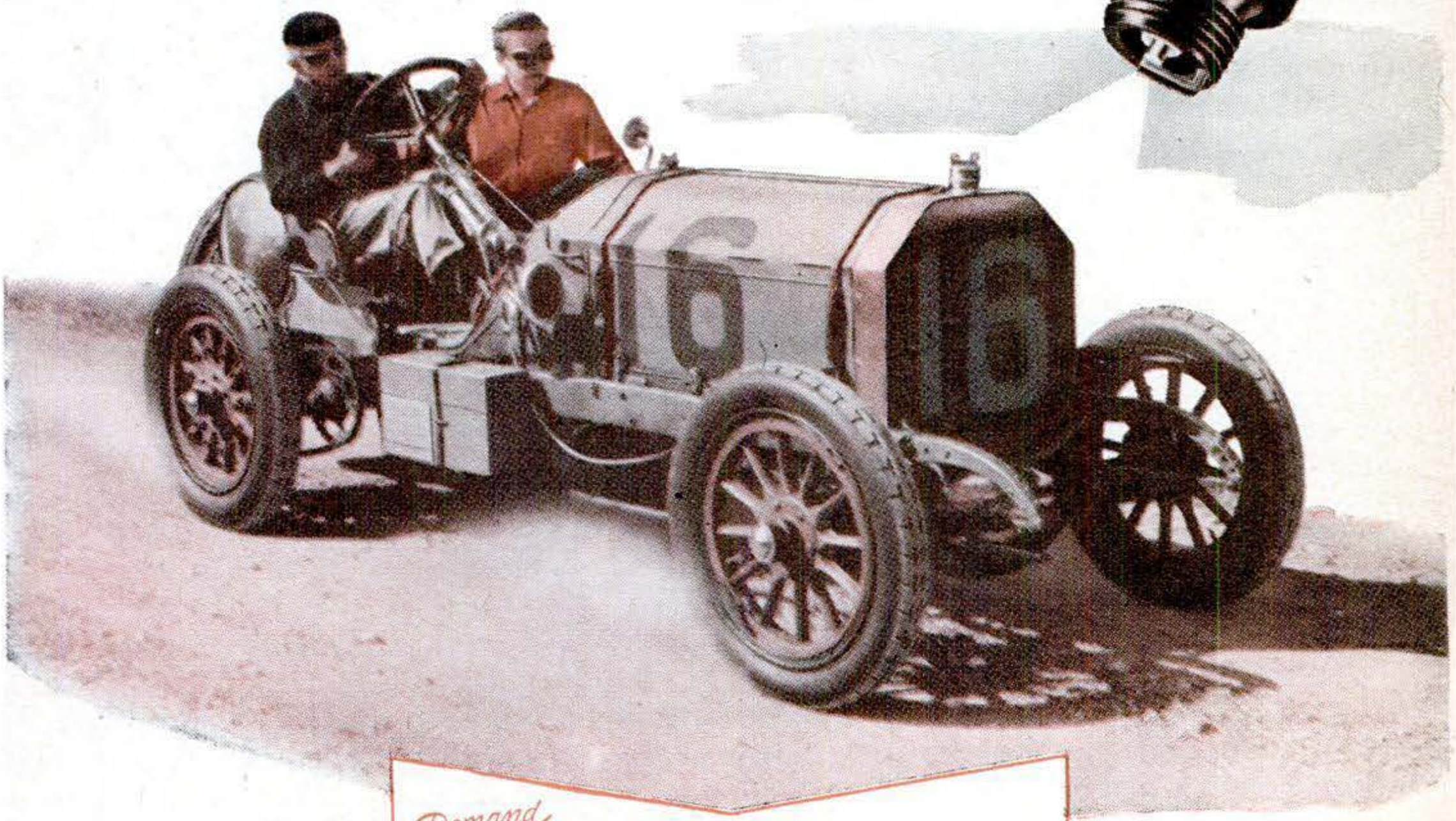
After nearly a half-century, legendary "Old 16," first American winner of the Vanderbilt Cup, still takes 100 miles per hour in its stride. This ancient Locomobile uses Champion Spark Plugs—as do the great majority of today's record breakers.

Apart from its historical significance, "Old 16" serves as a prime example of the value of proper care in protecting your motor car.

And proper care should include Champion Spark Plugs. Why Champions? Because the vast majority of engine experts agree that Champions will make any car, old or new, run better.

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Mr. Peter Helck, internationally-known artist and automobile connoisseur, is the owner of "Old 16." This car was designed by A. L. Riker and driven to its greatest triumphs by "Dare-devil" Joe Tracy and George Robertson.



FOLLOW THE EXPERTS *Demand* **CHAMPIONS** FOR YOUR CAR!

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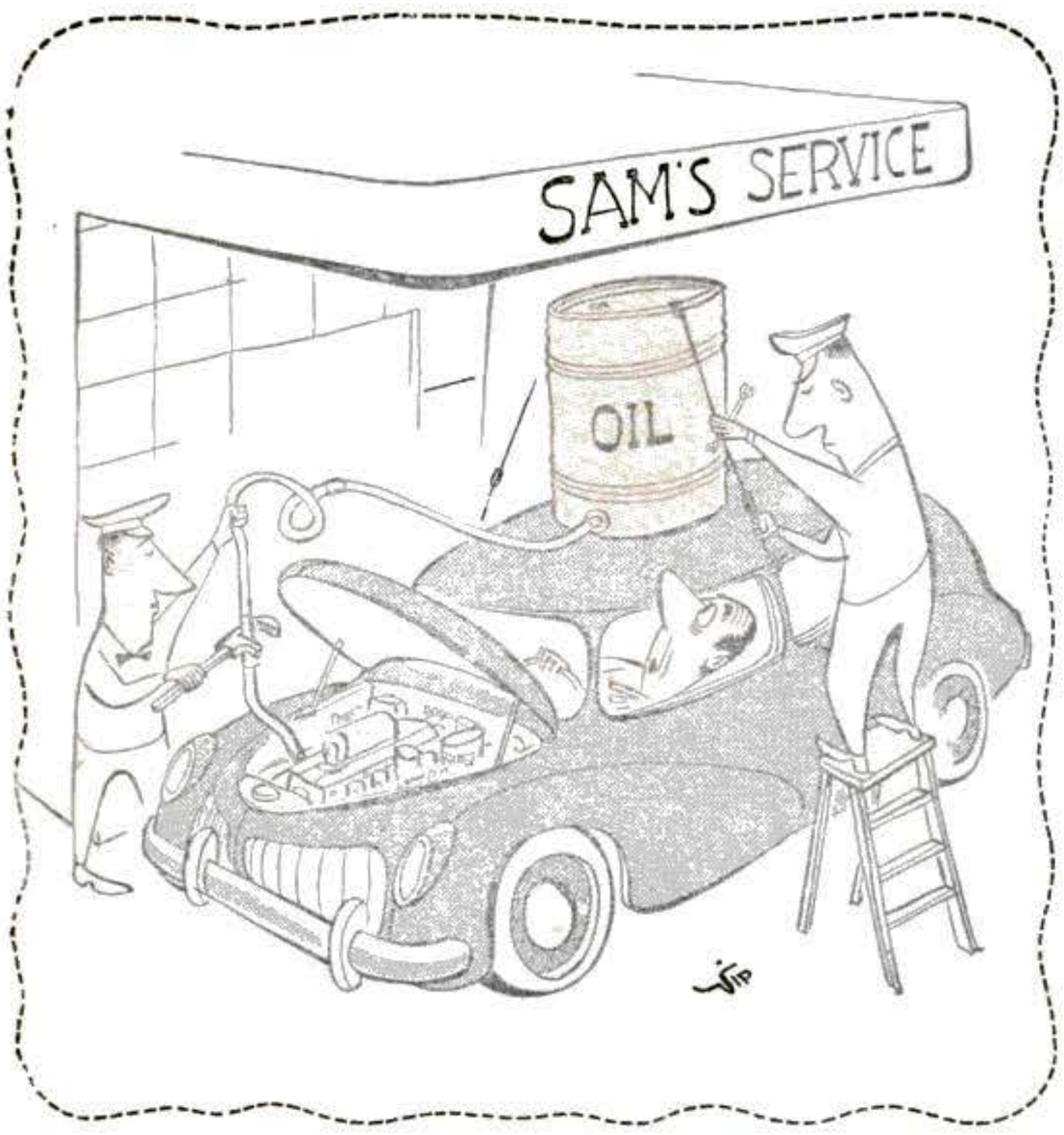


Quit driving an oil-burner—get new piston rings!

Oil pumping is just the start of expense and trouble—the first danger signal from worn-out piston rings. The longer you let those old rings stay in, the more oil you'll use, the more power you'll lose, and the bigger your repair bill will be!

As your engine gets older, it runs hotter because of accumulations in the cooling system. The cylinders wear tapered and out-of-round—need more oil on the walls.

It requires a special type of piston rings—replacement rings—to deliver this extra oil, under full control, without waste.

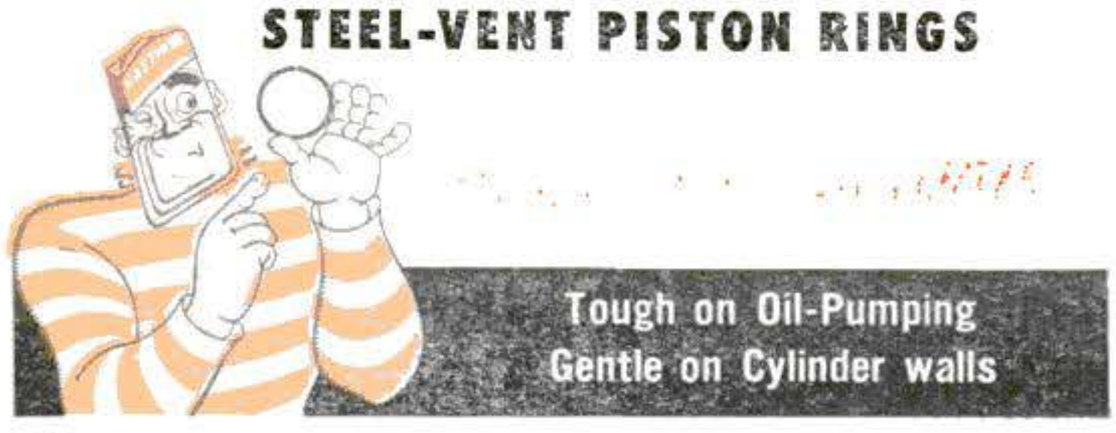
Hastings makes replacement rings exclusively, devotes all its research on the highways and in the laboratory, to the particular replacement problems of each make and type of engine.

That's why [illegible] *stop* oil-pumping, *check* cylinder wear, restore engine performance—in re-ring, re-bore and [illegible] installations.

So go to your motor specialist at the first sign of oil-pumping or performance drop-off. If rings are the trouble, ask him to install a Hastings Steel-Vent replacement set. Truly the best money you can spend on your car! Hastings Manufacturing Company, Hastings, Michigan; Hastings Ltd., Toronto; Piston Rings, Spark Plugs, Oil Filters, Casite, Drout.

HASTINGS

STEEL-VENT PISTON RINGS



"Squeezed" Movies Challenge 3-Ds

[Continued from page 210]

That stupendous Golgotha set is only one of 39 used in the filming of *The Robe*. One extends more than 200 feet from the camera to a distant throne. That means that lenses must be stopped down sharply to increase their depth of focus. Under the hopped-up lighting, any imperfection in the scenery stands out like a cracked ceiling in the Waldorf-Astoria.

Broadened real-estate, however, is not the only key to Cinemascope's dramatic punch. For years, the three-units-high, by four-units-wide, standard movie frame has been a miniature picture window through which you watch a story unfold in peephole glimpses. Each time a director wants to widen your view, he moves this window to the right or left, and it takes you the better part of a second to readjust your vision.

Cinemascope Helps Focus Attention

In Cinemascope, there are no picture windows. Your eyes roll casually about an unframed scene, dismissing unimportant details to focus on the story action. Don't think Cinemascope's directors and technicians aren't helping you along. Suppose they want you to swing your attention from Paulus, the centurion, to Marcellus, owner of the robe. The actors are 50 feet apart. But the camera makes no hasty, "panning" sweep to bridge the gap between them. Instead, an audio engineer boosts the pickup from one of the three mikes used to produce stereo sound. Lighting experts slowly shift their spots from Paulus to Marcellus, and the legate turns his head slightly toward the camera.

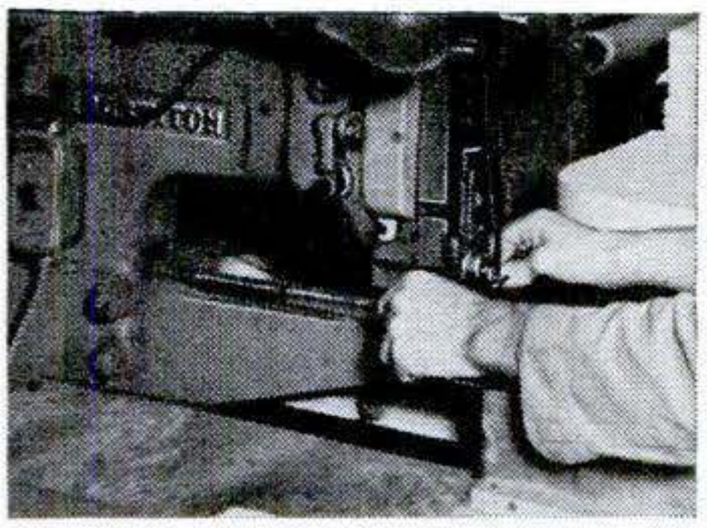
You do the rest, coached by the intensified output of the loudspeaker nearest Marcellus, and the eye-catching highlights on his face. END

A Relative Question

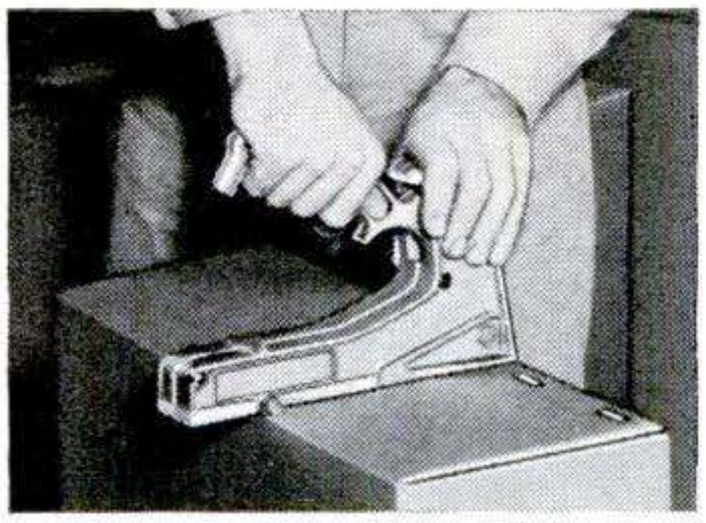
Ike: "Our dog is just like one of the family."
Mike: "Really, which one?"—*Wireco Life.*

HOW BOSTITCH MAKES THESE JOBS EASY

Tacking upholstery to chair seat, Bostitch T5AD Air Driven Tacker lets operator do it with one hand. Just squeeze, and Bostitch Tacker shoots staple into work. Drives staples almost as fast as operator can guide tacker . . . four times faster than hammer and tacks. Does the job faster and with less effort. Eliminates mashed fingers, damaged work, sore mouth from holding tacks.



Attaching pad to chair seat, Bostitch Stitcher takes only one-third the time. Does a neater, cleaner job. Stitcher makes its own staples inexpensively out of steel wire. Surer, stronger, easier than hammer and tacks. And they are only one-tenth the cost.



Sealing cartons, Bostitch Autoclench does job three times faster than tape and glue. Makes strong, neat seal with wire staple. Ingenious action clinches on inside entirely from the outside. Eliminates mess of water, smell of glue, cost of tape.

BOSTITCH is solving fastening problems in hundreds of different industries. Speeds production, boosts profits, makes jobs easier for workers. Let the Bostitch economy man help you with your fastening job. 300 fieldmen in 123 cities in U. S. and Canada. Write for free booklet.

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Please send me booklet of helpful suggestions for fastening.

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fastens it better AND FASTER with wire

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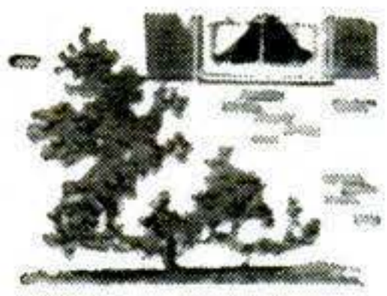
LOOSE BATHROOM TILES can be put back in to stay with tough "Duco" Cement. It's waterproof, too.

BUILD STRONGER MODELS. Quick-drying "Duco" Cement is standard equipment with most model builders.

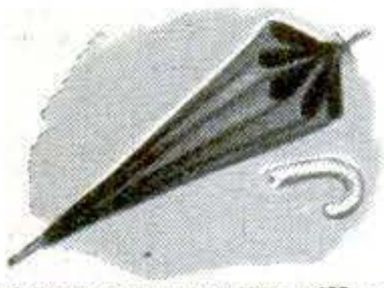
DROPPED GLASSES? Save the day by anchoring lens or replacing chips with transparent "Duco" Cement.

BROKEN FINGERNAILS get first aid with transparent "Duco" Cement to stop further damage.



TRAIN IVY on walls for distinctive decoration. Fasten string to wall with waterproof "Duco" Cement.

SCUFFED SHOES, leather heels and inner soles can be repaired in a wink with Du Pont "Duco" Cement



UMBRELLA HANDLES *will* come off... but they go back on to stay when fastened with strong "Duco" Cement.

CRACKED LENSES on flashlights will hold fast until replaced, if they're mended with "Duco" Cement.

A HOUSEHOLD FAVORITE FOR 25 YEARS

DU PONT

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BETTER THINGS FOR BETTER LIVING
... THROUGH CHEMISTRY

New Finds Tell of Monster Cave Bear

[*Continued from page 116*]

with their other accomplishments, they were skilled artists, and ornamented the walls of their caves with pictures of animals of their time, including the Great Cave Bear.

Cro-Magnon artists and later ones made their cave drawings, paintings and carvings, not alone for art's sake, but as primitive magic to assure plentiful game and good luck in hunting it. So concludes a French expert, the Abbé Henri Breuil, who has spent a lifetime photographing and studying prehistoric cave art. As he explains it:

"To picture a mare would promote the natural increase of horses. To portray the Great Cave Bear with many javelins sticking in him would assure success in hunting him."

Cave Drawings True to Life

These cave-man artists, he points out, were hunters whose lives depended upon accurate observation of animals. Hence, there is every reason to believe that their pictures are true to life and "have a genuine zoological value."

In fact, regardless of date, two attempts to visualize what the Great Cave Bear looked like stand out above the rest. One is a prehistoric outline picture of it, a rock carving that may be 20,000 years old, found by Abbé Breuil in a cavern at Dordogne, France. The other is a modern reconstruction of it in plastic, drawing upon the best available data from every scientific source, at the University of Vienna. And the striking thing about them is that Stone Age artist and present-day modeler arrived at a virtually identical picture of the Great Cave Bear. END

A Short Tale

Stranger: "I came because I read your ad in the paper for a man to retail canaries."
Proprietor: "Oh, do you want the job?"
Stranger: "Well, no. But I'm sure curious to know—how did the canaries lose their tails?"
—*Pure Oil News.*

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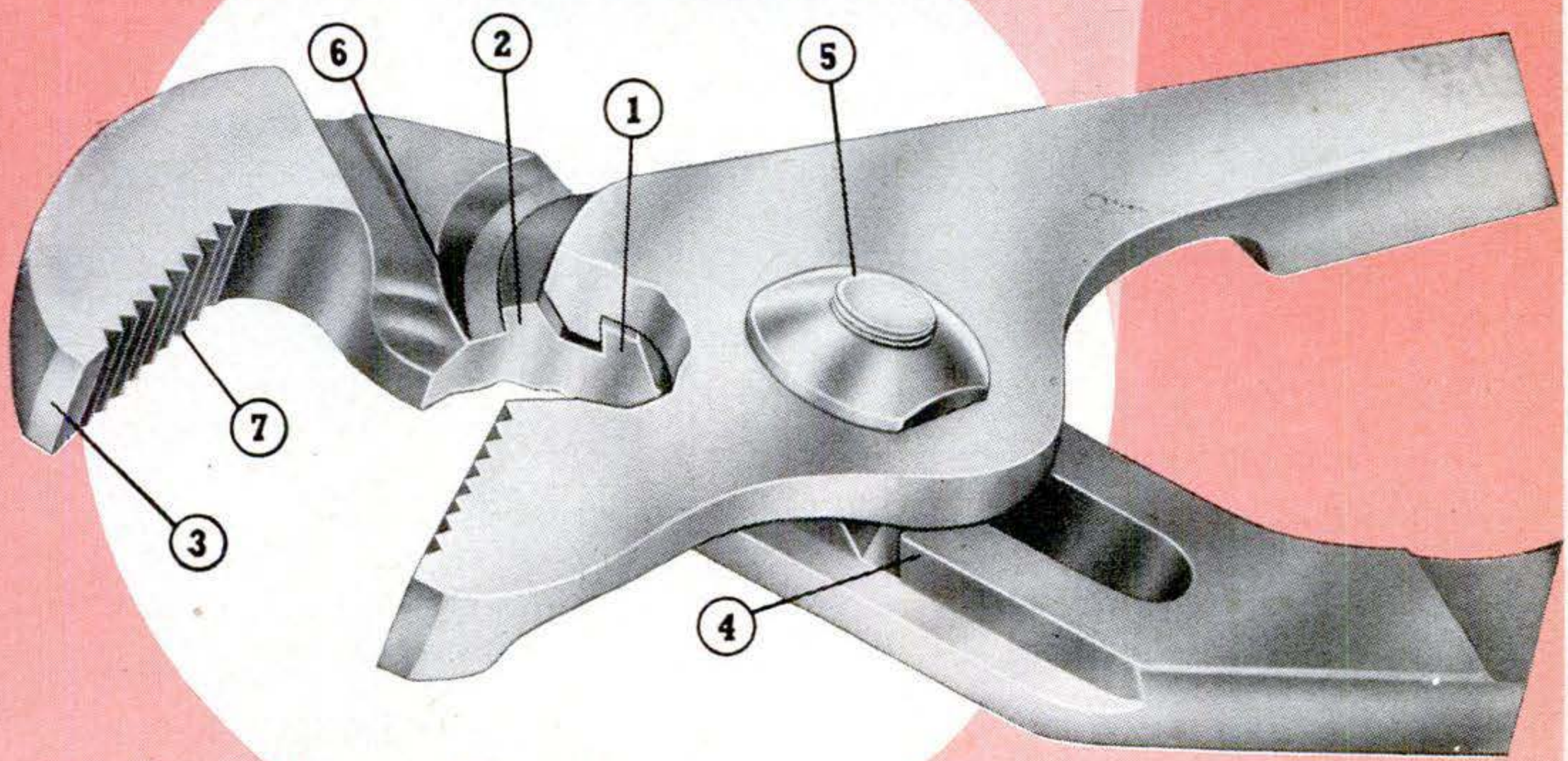
Here's the First NEW idea in plier design in years...

THE NEW No. 420

CHANNELLOCK **PLIER**

TRADE MARK REG. U. S. PATENT OFFICE



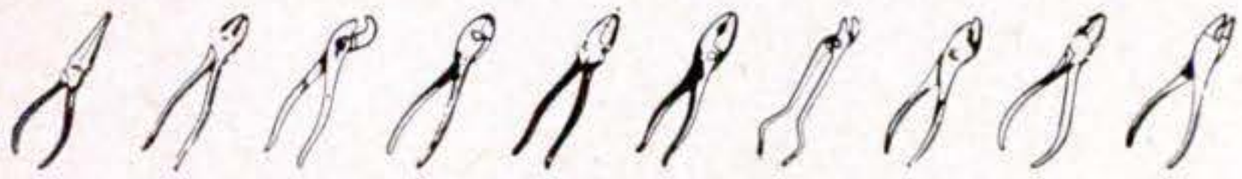
Look at these NEW features . . .

1. Interlocking principle positively prevents slipping under any load . . . the heavier the job, the greater the interlocking action.
2. New type wide base lugs provide maximum cross section strength . . . cannot shear.
3. New nose design provides greater utility for gripping small objects.
4. Patented design of tension edge provides more strength and eliminates stress concentration at channels.
5. New interlocking design minimizes stress on joint bolt.
6. Precision machined interlocking surfaces provide perfect fit, thus distributing pressure evenly.
7. "Rite Angle" teeth guarantee maximum bite and minimum wear.

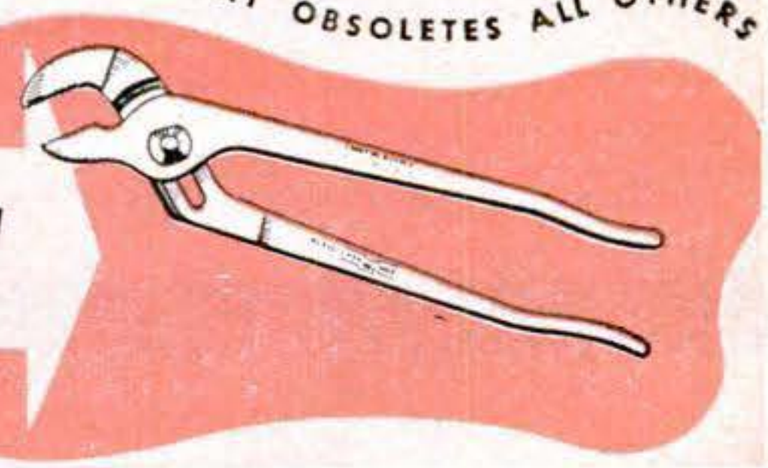
Here's the new, improved Channellock Plier—bringing to you new features which offer more positive gripping, greater strength and longer wear. The undercut interlocking channel is the first really new idea in plier design in years. Engineering skill has developed a plier with new patented features which give you the newest, strongest, most practical plier you can buy. Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

Send for your Catalog today.

Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"



THE PLIER DESIGN THAT OBSOLETES ALL OTHERS



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As You Step On the Gas!

when your car's equipped with a

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Enjoy your car to the fullest during these wonderful driving days. With a properly serviced CARTER carbureter, your car will run better, and you'll save on gasoline mileage.

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CARTER CARBURETOR CORPORATION
St. Louis 7, Missouri
Division of American Car and Foundry Company

"Golden Boy" of Motorcycle Racing

[*Continued from page 123*]

ing demands by using hand exercisers, doing pushups, running and swimming. He joins a Y for regular exercise in winter.

He owns four Harley-Davidsons, and takes their engines entirely apart about every two weeks. This is done to make sure that no parts are worn-out or too loose. If such conditions were ignored, an engine could fly apart at high speed.

When he gets a new engine, he takes that all apart, too, but for other reasons. He alters the four camshafts in a special, secret way and lightens up all the reciprocating parts. He and his mechanic slightly change the contours of the combustion chambers. With meticulous care, in reassembling the engine they fit the parts so that they will be as nearly frictionless as possible.

"That's the biggest speed secret there is, right there," he says.

Hurt Only Once

Goldsmith has been scraped and bruised a few times in the past seven years but badly hurt just once. That happened in Cleveland in 1948. He had taken a fall to avoid hitting someone else. In the few seconds that he lay at one side of the groove, another rider whammed across his feet and broke both of them. That put him out of racing for a year and a half. But when he was fully mended he went back to it with few misgivings and no trace of a limp.

When asked how long he intended to defend his present titles and try to win fresh ones, Goldsmith said, with a slow grin, "Well, the oldest guy competing in the Nationals last year was 55. That gives me quite a spell of racing yet." END

It's Not Easy

"For a man who hasn't any experience you certainly ask a high wage," said the employer to the young applicant.

"Well," replied the prospect, "the work is so much harder when you don't know anything about it."—*Clay.*

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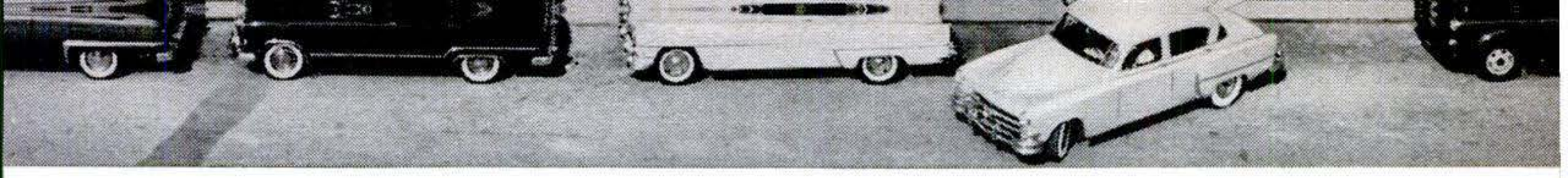


FULL-TIME POWER STEERING

A superior feature available only from CHRYSLER CORPORATION

Guided by one finger on the steering wheel, a Chrysler-built car slashes through hub-deep ocean surf—a tough spot for any car to be in—except with full-time power steering.

EXPLORING NEW WORLDS IN ENGINEERING

When you park, or turn a corner, or drive through skittery sand, you burn up muscular energy. The result is tension and driving fatigue.

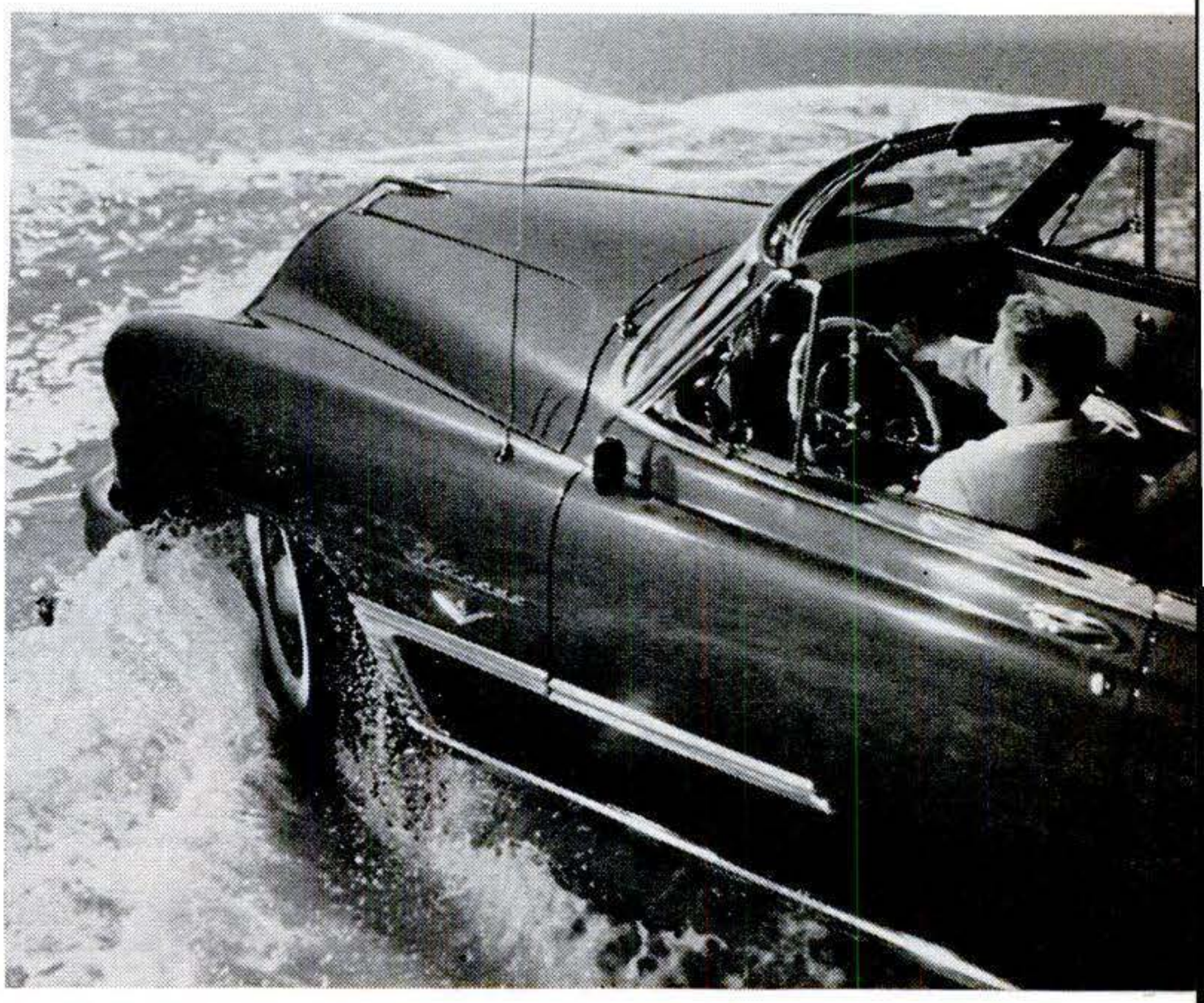
Now Chrysler engineers have taken the fatigue out of driving. They've harnessed hydraulic power to do 80% of the steering for you!

Steering now is absolutely effortless! Your finger tip turns your car wheel with ease, even at a complete standstill. Parking is a look, a turn, a straightening up, and you're in!

What are the superior features of this *exclusive* Chrysler system?

Chrysler's revolutionary power steering system reports for duty the moment you start your engine. And it stays on the job every minute your engine runs! It responds instantaneously—unlike other devices, which do not go to work until the driver has applied four or more pounds of steering pressure.

This is the *only* system that enables you to drive hour after hour without steering-wheel weariness. Chrysler's all-the-time steering is so relaxing that many doctors now are willing to allow persons to drive who before could not stand the exertion.



Creative Engineering that brings you the good things first. A Chrysler-built De Soto cuts effortless capers in sand and ocean surf at Daytona Beach, Florida. It demonstrates the handling ease and positive safety control of full-time power steering, another Chrysler Corporation "first," now available on Imperial, Chrysler and De Soto cars.

Even the steering ratio has been greatly reduced. Other mechanisms require up to *five* rotations of the steering wheel to turn through a full arc. The Chrysler system requires *only three*. This means faster, safer steering than you can get with any other available system.

The Chrysler system also soaks up road shocks. Its hydraulic action helps hold your car serenely on course—even if you drive over ruts or suffer an unexpected blowout.

Chrysler engineers introduced full-time power steering for passenger cars in 1951. This Chrysler "first" is another example of engineering leadership that continually, year after year, puts *more value and worth* into all Chrysler Corporation cars.

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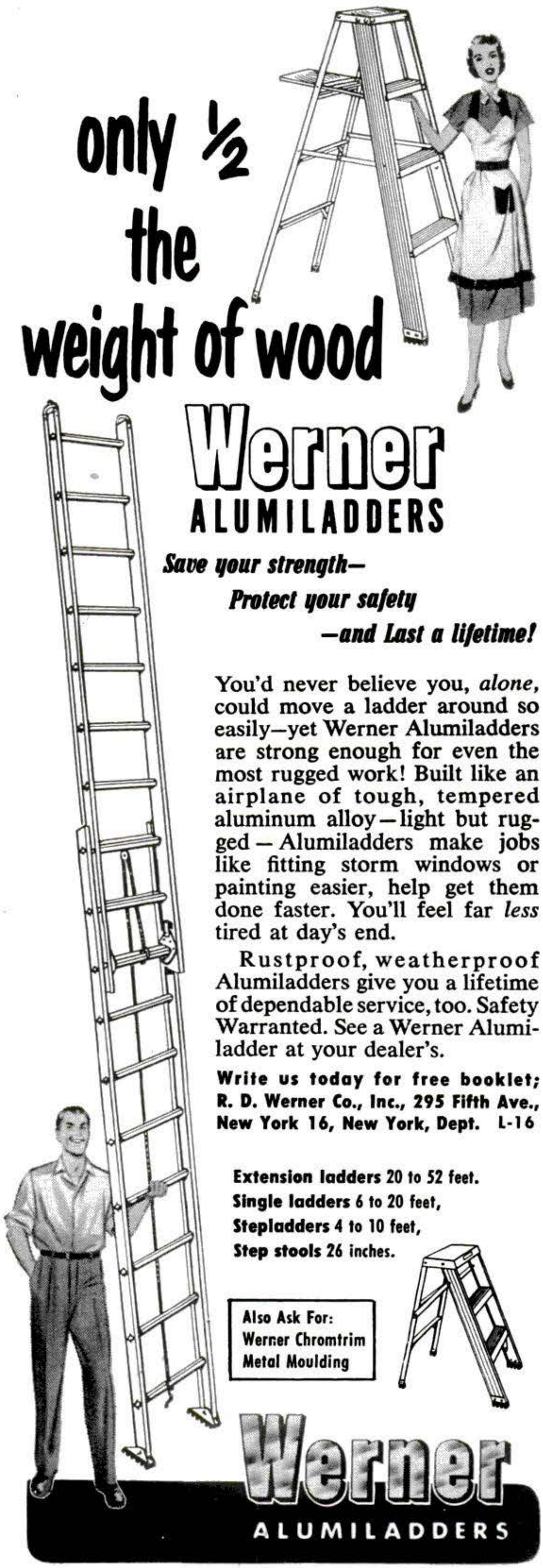

Gus Peps Up a Tired Truck

[Continued from page 160]

"I didn't have any trouble," Glen was saying, "until I started to work on the harvest last week. That is, except for the broken butterfly shaft."

"Broken butterfly shaft!" Gus was all ears now. "Those shafts wear, but they don't often break. Something must have jammed it."

"The throttle stuck at slow speed," Glen explained. "So I rammed my foot down hard on the accelerator and the motor stopped. It took me a while to find out that the cross shaft in the carburetor, where the butterfly valve is attached, had let go. The truck quit almost in front of the Danesville junk yard, so I had them put in a used shaft. That fixed things up as good as new."

Gus Fumbles Through Tool Kit

When they got back to the Model Garage, Gus got down and wheeled over his tool kit. Then he began fumbling through it, as though he was looking for something he couldn't find.

"Funny," he said. "I need a real small screwdriver. And I don't seem to have one here."

Working on the grease rack, Stan Hicks cocked a quizzical ear. What was the old fox up to? Gus had all kinds of screwdrivers in the kit drawer.

Glen got his tools out of the truck and offered Gus an eight-inch driver.

"This," he said, "is the smallest one I've got."

"Then how did you manage to get out those two tiny screws that held the butterfly to the broken cross shaft?"

Glen looked puzzled.

"Why, I didn't have to, Mr. Wilson. That butterfly valve was loose in there. I just lifted it out."

Gus kicked a trough under the radiator, and slid in beside it to turn the drain cock. When he had run all of the water off, he removed the engine head and called Stan Hicks over.

Stan Mans the Crank

"Turn her over slow with the crank," he told his helper.

As each intake valve came up, Gus thrust a tiny inspection mirror underneath it, and flashed a pencil light on the mirror, so he could see the reflection of the valve facings.

[Continued on page 220]

First home television camera, RCA's "TV Eye," connects to any TV set—lets you watch children in the nursery or at play.

Tireless "TV Eye"

New RCA TV camera an alert watchman for home, school, industry

Based upon the vidicon tube, developed by RCA, a new instrument is on the way for homes, business, and schools—the RCA "TV Eye."

Light, compact, easy to use, "TV Eye" is a camera unit which can be connected to standard home receivers—makes any of the 23 million TV sets now in use a potential closed-circuit television system.

RCA's industrial version of the vidicon camera has already proved its place as an observer and guardian in science, industry, transportation, business—with new uses still being explored. Wherever distance or danger preclude a human observer's presence, the vidicon camera can take his place.

"TV Eye" plugs easily into standard TV sets. You just switch to the selected channel, and see everything that the camera sees.

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COMMUNITY INDUSTRIES ASSOCIATION, SULLIVAN, ILLINOIS

Gus Peps Up a Tired Truck

[*Continued from page 218*]

On cylinders 3 and 4 he found barely visible marks on the newly ground seats. As he turned to face Glen and Enid there was a smile of complete satisfaction on his rugged features.

"Your troubles are over, kids," he told them. "The two screws that held the old butterfly valve to the carburetor shaft worked loose. That let the butterfly valve cock in the carburetor throat, and jam. When you rammed your foot down hard on the throttle, the shaft broke. You had the junk-yard boys install another shaft, but you forgot the two screws from the old one. Right now, they're down under the intake valves of Numbers 3 and 4."

"But I don't get it, even now," Glen sputtered. "The motor idles good. Why in the world should it only miss when it turns over fast?"

Gus Solves the Problem

"That's easy," Gus grinned. "The two screws are under the valves in the intake passages. When the engine's idling, there isn't enough suction to lift them up under the valve faces. But there *is* enough when the motor revs up. The screws are too large to pass completely under the valve heads and into the cylinders, but small enough to get under the valves and hold them open. When you idle down again the suction drops off and they fall back into the little pocket by the valve stems. Now, we'll just pull those two intake valves, remove the screws, and grind the valves—they're a bit rough."

Gus got busy, trying to ignore the appreciative eyes of Enid Bishop. There was a bigger reward in this job, he told himself, than the small bill Glen would pay up when the harvest was in. One of these fine days Gus Wilson was going to be invited to a wedding. END

Next month: Gus saves the old homestead.

Deprived of Its Prey

A MOUNTAINEER, seeing his first motorcycle roaring along the road, raised his rifle and banged away.

"Did you git the varmint?" called his wife.

"Hit it but didn't kill it," came the answer. "I can still hear it growling—but I sure made it turn that pore man loose."—*L & N Magazine.*

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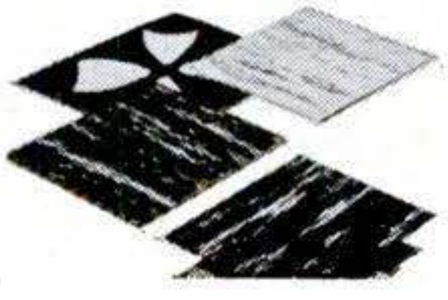

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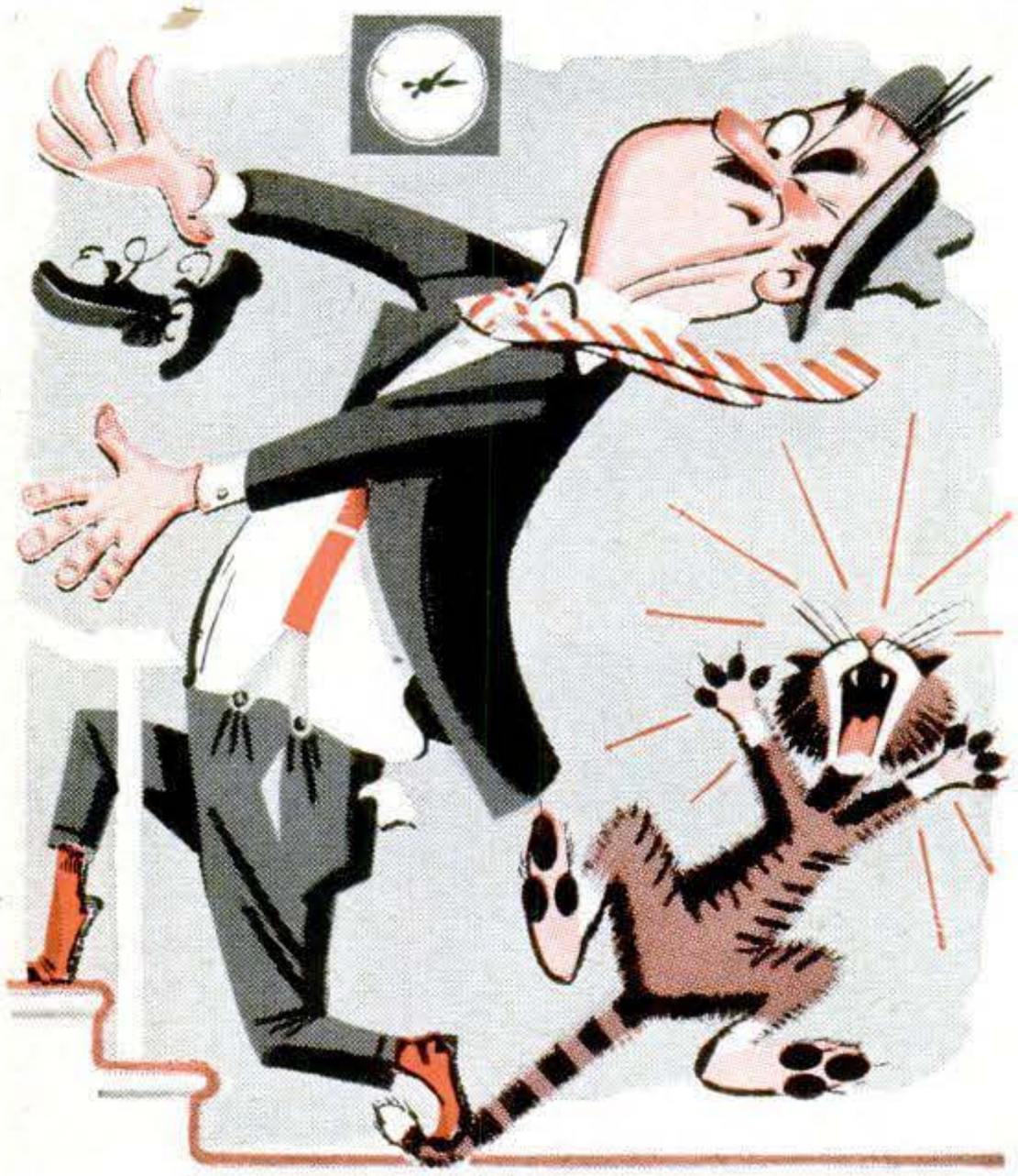

AND TO RESTORE
CAR PERFORMANCE

OIL-CONTROL STARTS HERE

To stop oil-pumping, replace worn engine connecting rod bearings

Trouble sometimes comes from unexpected quarters. An oil-pumping engine is an example. You may blame the piston rings for oil pumping caused by excessively worn engine bearings. *Correction must start at the worn bearings!* They shorten the life and decrease the efficiency of the best of new piston rings. Give new rings a chance to do their own job—check for worn engine bearings, too! Replace, in sets, with Genuine Federal-Mogul Oil-Control Bearings for renewed power and economy. *Ask your mechanic!*

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CARE WILL SAVE YOUR CAR

CONTROL OIL-PUMPING
WHERE IT STARTS—REPLACE WITH

FEDERAL-MOGUL
OIL CONTROL **BEARINGS**

He Recaptures Aviation's Old Days

[*Continued from page 68*]

eran pilots to fly essential cargoes from the U. S. to India.

In 1946, he flew a P-38 in the Bendix Race from Los Angeles to Cleveland. Among those who saw him off when he left Minneapolis was his daughter, whom he took aloft for the first time when she was a baby, strapped to his lap. This time she had two of her three young sons with her. Reporters promptly dubbed Bullock the "Racing Grandpa."

Duplicated Parts from Memory

The experience that Bullock gained restoring the Curtiss pusher that his father gave him, and patching it whenever he crashed it, made it relatively easy for him to build a copy of the plane years afterward. He made no attempt to locate original Curtiss parts, assuming that would be impossible. Instead, from an excellent memory and from pictures in his scrapbook, he duplicated his Curtiss with modern parts and materials.

Bullock would have liked to use wooden struts and tail surfaces and bamboo booms in the copy, like those on his first Curtiss, but he decided instead on steel piping and modern fabric.

Wings Proved Problem

He knew, from repeated practice in the old days, how to build the wings, but he didn't know what their degree of curve should be. This was of vital importance. Being unable to drop in at the Smithsonian Institution and take wing measurements of the only Curtiss pusher he knew to be in existence, he devised an ingenious substitute. He selected the best side view of his old plane from his scrapbook and had it greatly enlarged. Then, calling upon the mechanical-drawing knowledge he had acquired in high school, he plotted the curves of the wings from the photo.

The wings of his present plane were made exactly as the original ones were. The spars are of 1⅛-by-2¼-inch clear

[*Continued on page 224*]

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NEW *Atlas* GRINDER-HONE

Slickest Tool You've Ever Seen!

This unique new combination grinder and hone enables you to put a perfect edge on almost any tool or implement — from knives, scissors, hatchets, garden tools to plane blades, chisels, drills. Add a wire brush or buffing wheel and you're set to clean and polish a host of equipment.

The 6" grinding wheel turns 3000 RPM, the 5" oilstone hone (with 120 and 320 grits) turns 110 RPM. Tool is ruggedly built — grey-iron base, sealed-for-life ball bearings and Oilite bearings. Weighs 22 lbs. Operates from ¼ to ⅓ HP, 1725 RPM motor. See your Atlas dealer, or write for literature. Price F.O.B. Kalamazoo $31.50.

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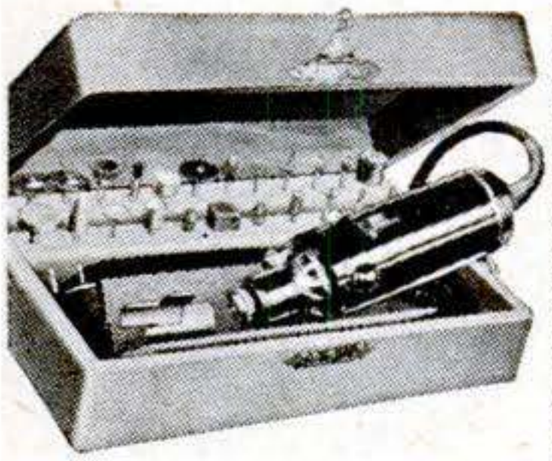

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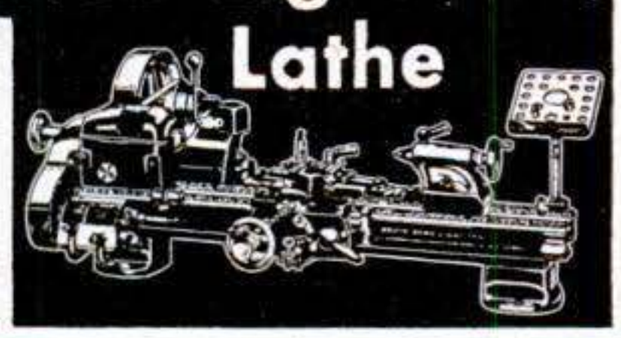

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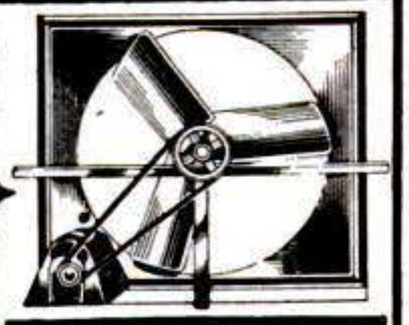

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WESTAIR FAN & BLOWER CO.
5650 Grand River, Dept. M Detroit 8, Mich.

He Recaptures Aviation's Old Days

[Continued from page 222]

spruce, laid flat instead of endwise. The ribs are of 1⅛-by-⅜-inch laminated spruce. The frame is covered with ordinary airplane-wing cloth.

Bullock, however, added certain refinements that Curtiss hadn't dreamed of—instruments, for instance. All the original pusher had was an ignition switch. Bullock added an altimeter, a tachometer, an airspeed indicator, oil gauges and a primer—all from a Piper Cub—and installed them on a horizontal panel at the right of the pilot's seat.

The original overhead fuel tank held eight gallons of gasoline. Bullock prefers a streamlined 25-gallon substitute.

In the original plane, the pilot worked the ailerons by means of a shoulder yoke. "You leaned to the high side in those days," Bullock explained. Now his ailerons, in conventional fashion, are operated by the steering wheel.

It Is No Speed Demon

The present Curtiss retains one disadvantage that the original plane had. It can't be steered on the ground. If Bullock wants to turn at one end of his 900-foot turf runway, he has to climb down and lift the tail of the plane around.

The entire job of duplicating Bullock's old Curtiss was finished in two months, and the plane flew satisfactorily on its first trial.

Glenn Curtiss once set a world's speed record—an impressive 61 miles an hour—with the original model of this plane. The best Bullock has been able to do with his copy is 55 miles an hour. This was no surprise to him, however. Even in his original Curtiss-made Curtiss, he once lost a straightaway race with a Lake Minnetonka interurban trolley. END

Can't Fool Him

First Urchin: "Can you stand on your head?"
Second Urchin: "Course not, silly; it's too high."
—*Burns and Mixes.*

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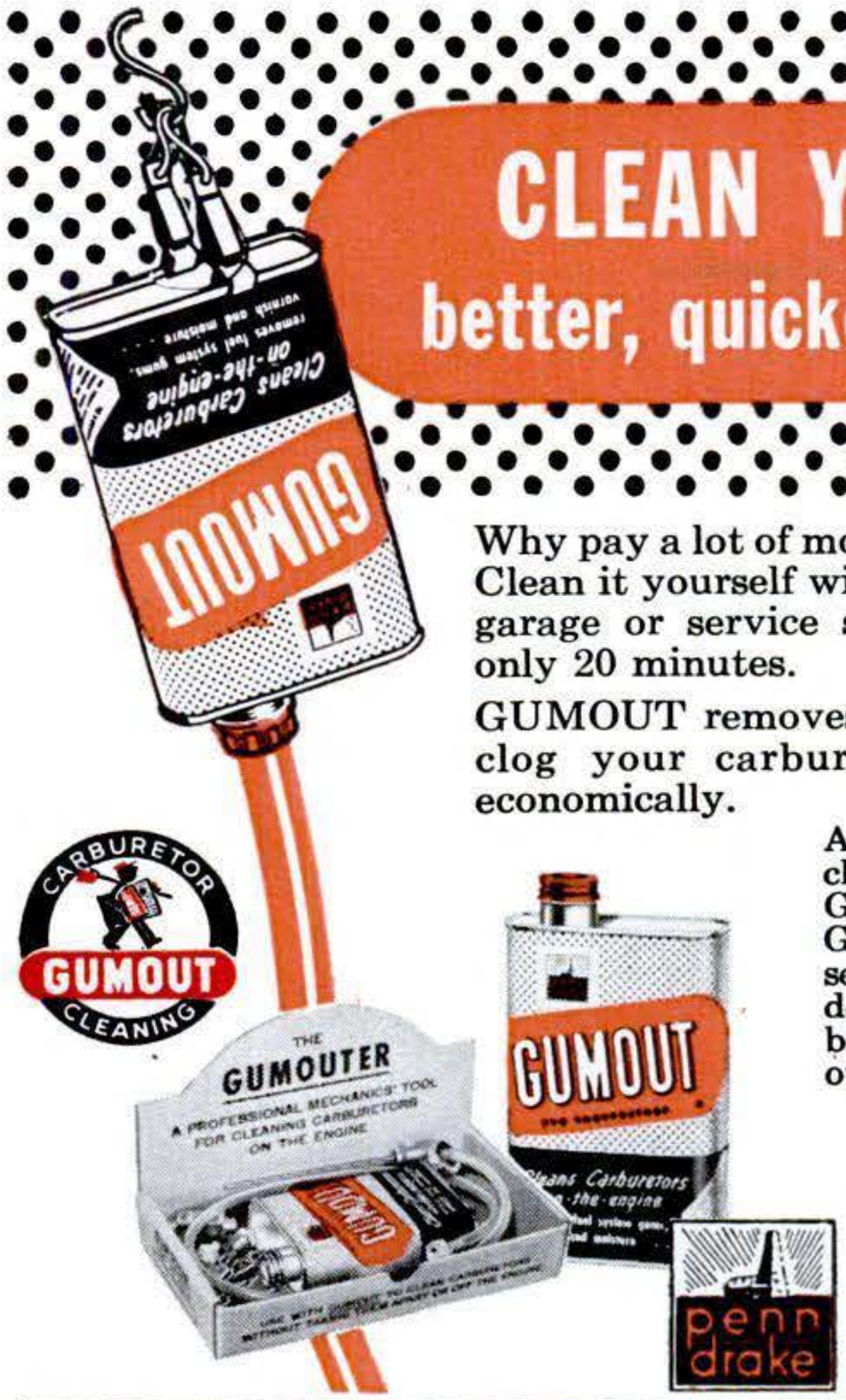
CLEAN YOUR CARBURETOR
better, quicker, cheaper with GUMOUT



Why pay a lot of money to have your carburetor taken apart and cleaned? Clean it yourself with GUMOUT—right on the engine. Or, your favorite garage or service station can do the job for you with GUMOUT in only 20 minutes.

GUMOUT removes all the dirt, muck, moisture, gum and varnish that clog your carburetor. Your engine will run smoother and more economically.

A single pint of GUMOUT costing only $1.50 will thoroughly clean *any* carburetor. The easy-to-use applicator called the GUMOUTER lasts indefinitely and sells for $4.75. Get GUMOUT and the GUMOUTER from your auto supply store, service station, garage, speed shop, or implement dealer. If not available locally, order direct. And be sure to write for a *free* copy of our helpful Carburetor Handbook.

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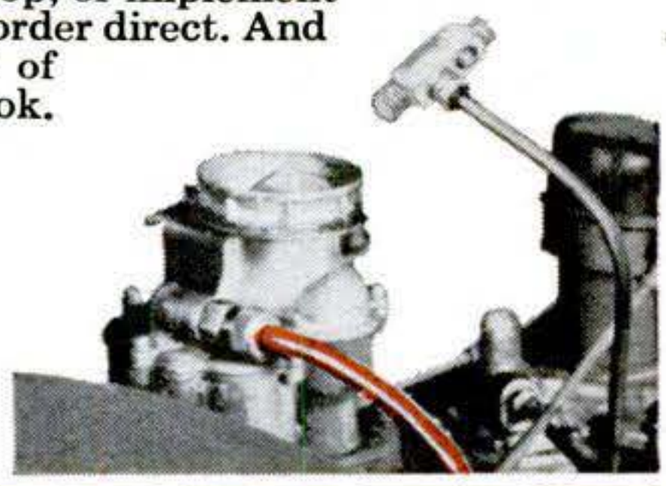

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REDMAN TRAILER CO., ALMA 38, MICH.

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[Continued from page 96]

His thrust is instantaneous when he pushes on the control levers.

How soon the turboprop will become a commonplace on U. S. airlines depends in part on when they want it. The armed services have Allison-powered turboprop fighters, patrol planes and transports a-building or on order. British European Airways already has some turboprops in service.

May Reduce Airline Fares

Turboprop airplanes have qualities of their own that neither jets nor piston airplanes can match. They are not as fast as jets but they're more economical. They fly farther on a gallon of fuel. They can get into and out of small airports that jets—and even the bigger piston transports—can't negotiate.

Turboprops use more fuel than piston engines but they weigh a lot less and therefore can carry more, and the fuel costs only half of what high-octane gas does. It's possible that the turboprop eventually will help reduce airline fares even below today's "coach" or "tourist" rates.

A turboprop will produce twice the horsepower of a piston engine for each pound of weight. A Turbo-Liner pilot, anxious to get home, was glad of that the other day. Still a good many miles from Indianapolis, one of his engines swallowed an unidentified solid object. The compressor was damaged. Automatically the engine shut down. Automatically the prop feathered.

But the plane wasn't far behind schedule when it landed. It raced home on one engine—at 220 miles an hour. END

Next month* POPULAR SCIENCE *will show you how to build a turboprop model that flies and sounds like a big plane.

Danger Sign

TO ERR is human, but when the eraser wears out before the pencil, look out.—*Texas and Pacific Topics.*

"I can't get him to wear his hat since he discovered Wildroot Cream-Oil!"

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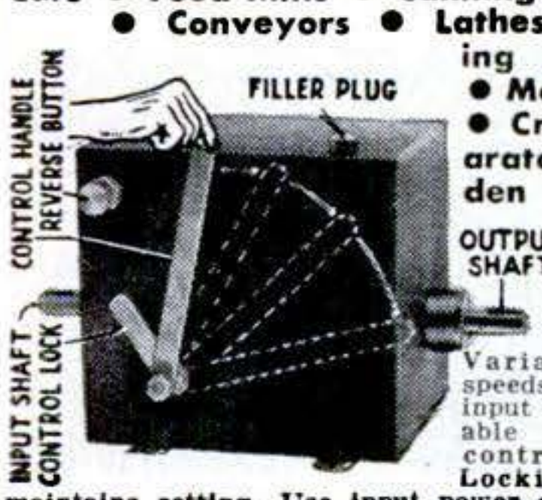

Variable output speeds from 0 to input speed available by moving control handle. Locking handle maintains setting. Use input power of 1/4 to 1 1/2 H.P. This Westinghouse-Oil Gear Unit consists of a variable displacement hydraulic pump feeding a fixed displacement hydraulic motor. Adjustable relief valves set at factory for 100 inch pounds of torque may be reset up to 180 inch pounds. Independent reverse control allows full output power and speed selection in either direction of rotation. Shafts measure 5/8" diam., include keyway. Input rotation is counter-clockwise facing shaft. Recommended input speed not to exceed 750 R.P.M. Over-all dimensions, 7 1/2"x7 1/2"x11 1/2". Gov't acquisition cost $428.00. Ship. wt. 31 lbs. Complete with 2 qts. of oil and full instructions. F.O.B. Chicago **54.50**

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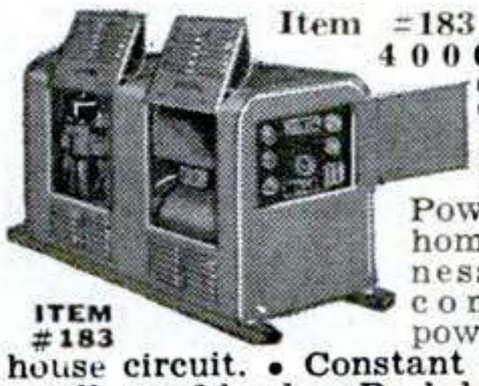

ITEM #183

Item #183 — 3000 to 4000 WATT GENERATOR SET —FEATURES— Power for your home or business. Simply connect to power panel or house circuit. • Constant voltage regardless of load. • Push button start or stop. • Easily made full automatic start or stop. **SPECIFICATIONS—** Sizes 19"x30"x48". Steel skids, weatherproof housing, requires no building. Wt. 725 lbs. • Hercules 4-cyl. 10 HP gasoline engine. Load governor. Oil filter. Quiet muffler, 6-volt starter, generator. • Hobart 115 volt, 60 cycle, 3000 to 4000-watt generator. Furnishes either single or three-phase power, 2 or 3 wire. • Panel contains oil gauge, voltmeter, ammeter, circuit breaker, voltage regulator, start button. Today's cost over $1200.00. SALE PRICE, F.O.B. Chicago..... **465.00**

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ITEM #303—use for air compressors, surge tanks, CO-2 tanks, liquid containers, floats, buoys. 24" long—4" diameter — 1/2" pipe thread port. Ship. Wt. 10 lbs. F.O.B. Chicago..... **2.50**

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Brand New

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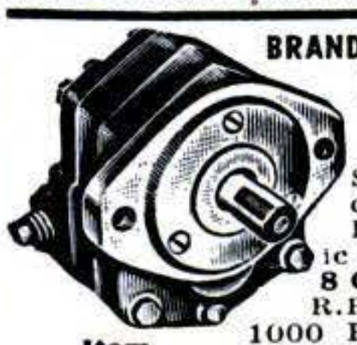
TYPICAL PERFORMANCE DATA

Suction Lift	Head Pressure	Gal. Per Min.	H.P.	R.P.M.
10'	75'	260	6.0	3500
10'	65'	200	5.2	3500
10'	80'	40	1.5	2500
10'	50'	140	5.0	3500
10'	30'	100	3.0	2500

BRAND NEW MULTI PURPOSE HYDRAULIC PUMP OR MOTOR



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Item #1036

Item #1036—Double acting hydraulic cylinder, 3" bore, 36" stroke, 1/2" pipe thread ports. 1 1/4" solid steel shaft. Overall length closed 49", clevis mounting at base and shaft. FEATURES ● Cup & Chevron Packing ● All Welded Construction ● Precision Ground and Honed Construction ● Will lift 7000 lbs. using 1000 P.S.I. line pressure. Weight (net) 57 1/2 lbs. F.O.B. Chicago **50.00**

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Item #126—Four-way, open center control valve with built in adjustable relief valve. Factory set at 1000 P.S.I., spring loaded neutral position, for use with one double acting cylinder. In neutral position cylinder is locked and pump unloaded. Fully balanced plunger type, smooth, positive, easy operation. Can be used as single unit or mounted in series of any combinations desired. Has 3/4" pipe thread inlet and outlet. 1/2" pipe thread cylinder ports. Newly manufactured to our specifications. Shipping weight 8 1/4 lbs. An outstanding buy! F.O.B. Chicago..... **21.50**

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Size 8:00x4, 4 ply, smooth tread —uses straight 1 1/4 in. axle, 6 in. wide. Overall height 17 in. Static Load 900 lbs. **Weight 13 lbs., Price $27.50 ea.**

Size 10 1/2 x 4, 6 ply ribbed tire. Uses straight 5/8 in. axle, 3 1/4 in. wide. Overall height 10 1/2 in. Static Load 1,200 lbs. **Weight 8 lbs., Price $9.95 ea.**

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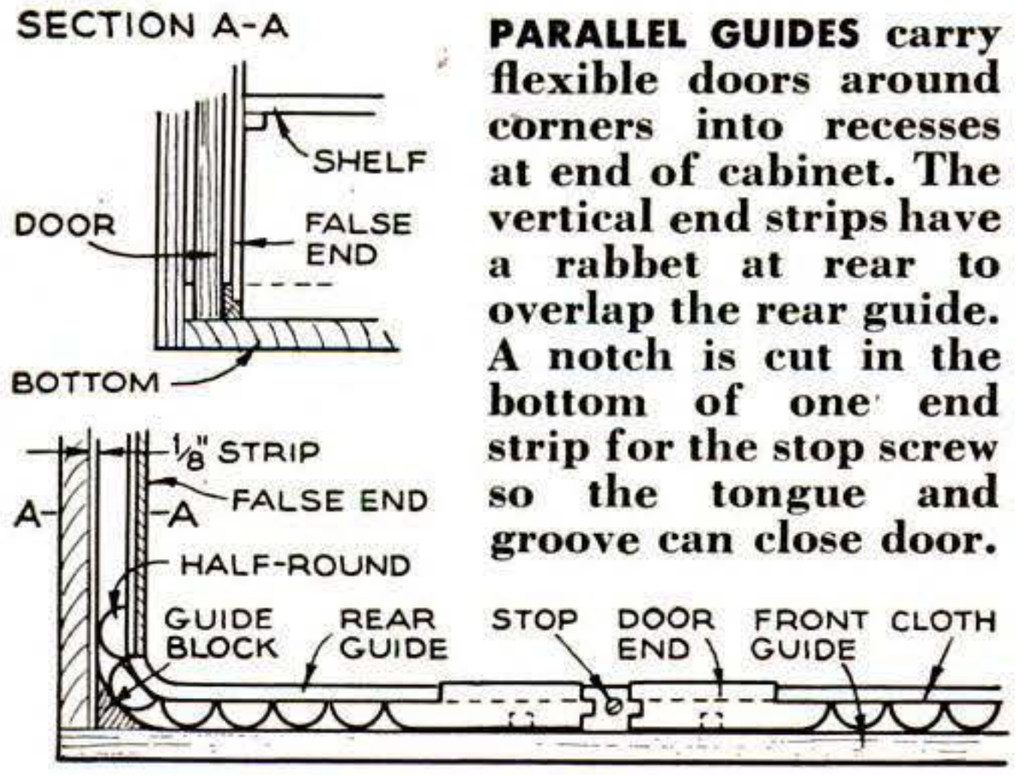
Sliding Door Turns Corners



PARALLEL GUIDES carry flexible doors around corners into recesses at end of cabinet. The vertical end strips have a rabbet at rear to overlap the rear guide. A notch is cut in the bottom of one end strip for the stop screw so the tongue and groove can close door.

Unit made of wood strips slips out of sight in cabinet ends.

CABINET doors that slide around a right-angle corner are often the solution to a home-construction problem where conventional swinging doors would take up too much space or be skull-denters.

These doors require a quantity of straight wood strips, not too wide and not too thick. I used redwood half-round, the kind intended for screen molding. These strips are about 5/16″ thick and ⅝″ wide.

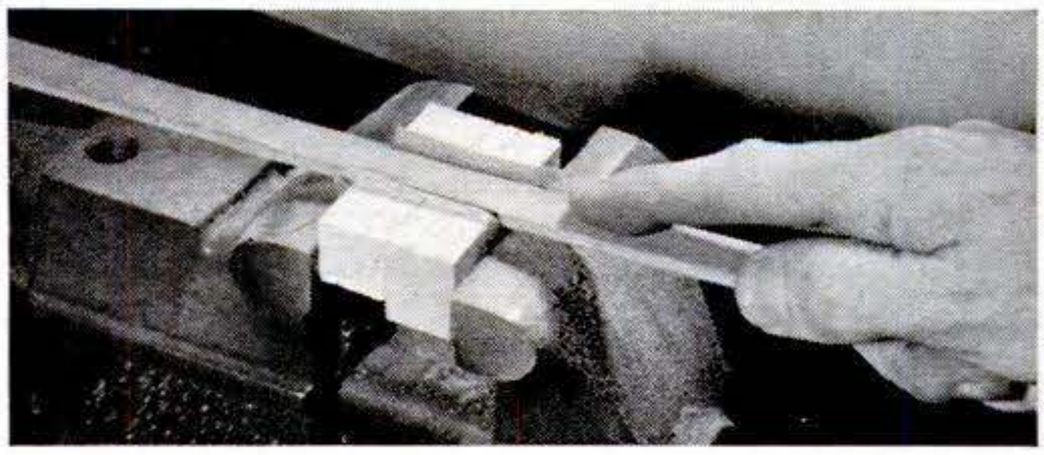
Cut them to equal length and arrange side by side until you have a door of the desired length. Then sand them smooth and apply shellac, lacquer or other finish to the curved surfaces.

Fasten together by pressing strips of gummed paper against the flat sides of the half round, aligning the paper about 1/16″ from each end. Cut a piece of thin, tough cloth large enough to cover the back of the entire door except where the paper strips have been applied. Glue the cloth in place.

On my doors, I used two ¾″ by 3″ wood strips for the vertical end pieces, cutting a tongue and groove to form an interlocking, dust-resistant joint. Rout finger grooves in these.

The doors can slide in grooves either routed in wood strips or formed by fastening two parallel strips to the top and bottom of the cabinet. Parts of the trim can serve as outside guides. At the cabinet ends, install curved wood blocks to make the door turn the corner. If the cabinet is to have shelves, install false end panels between the top and bottom of the cabinet to support them. The doors then slide into this recess, between twin guides at the top and bottom.

For a narrow cabinet, a single door sliding into a recess at one end will do the job. If the width of the cabinet is not too much more than twice its depth (front to back), two doors are best. These should meet at the middle of the cabinet. For an extremely long cabinet, more than two sliding sections could be used, only the end ones being required to turn the corners.—*Walter E. Burton, Akron.*



SANDING BLOCK for smoothing half-round strips was made by boring hole through block, splitting it in half, and gripping halves in vise. Let vise grip ends of sandpaper, too.

CLOTH IS GLUED to strips to hold them together and make door dustproof. Apply adhesive to the cloth in a band two or three strips wide, press this area in place and repeat.

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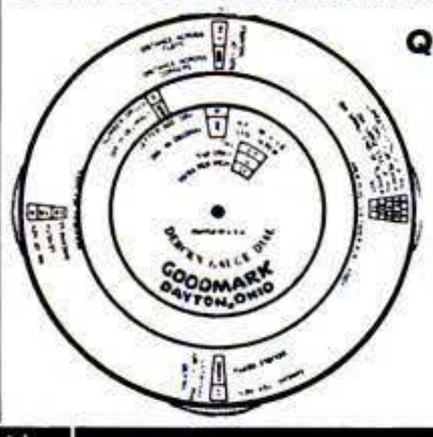

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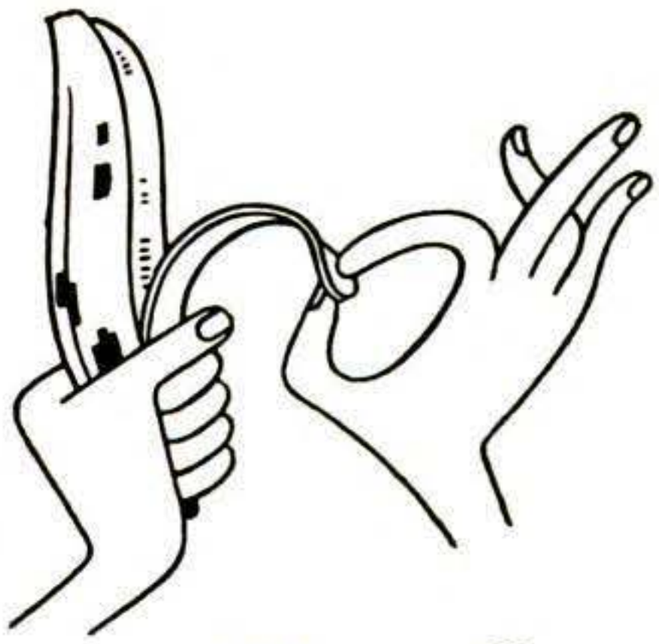

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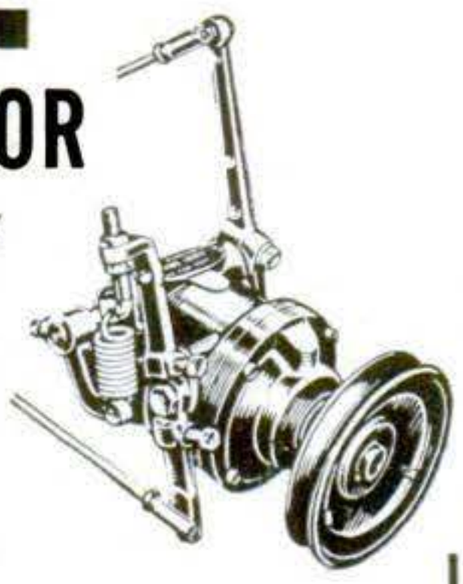

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New Magic Bullet Cures Old Disease

[Continued from page 89]

Did it have such a strong hold on the penicillin parts of the molecule that the valuable antibiotic would never get loose to kill microbes? No—the grip could be broken in the body and penicillin would be released slowly.

They Tested 500 Different Chemicals

Could some related substance do a better job? Apparently not—Dr. Seifert and his co-workers tested about 500 different chemicals and the DBED-penicillin compound still held No. 1 spot by a wide margin. Animal experiments indicated that it wasn't poisonous.

The groundwork was completed. But new drugs have to pass a long barrage of trials on carefully selected patients before they're accepted for general use. For a while it seemed that Bicillin would never be run through such elaborate clinical routines. But during a conference on new products a desperate Wyeth executive blurted: "If we only had something to kill the taste of penicillin!" (That was more than three years ago, when certain penicillin tablets were bitter and nauseating.)

Dr. Seifert put in a good word for Bicillin. He'd tried it once and found it quite palatable. So the drug finally came into the limelight, because it happened to be tasteless. But it had a "bonus" effect. Taken by mouth it proved effective as a germ-killer for an average of six hours, despite the destructive power of stomach acids. Doctors soon wondered how long it would last in the form of hypodermic doses—and they found out.

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[Continued on page 232]

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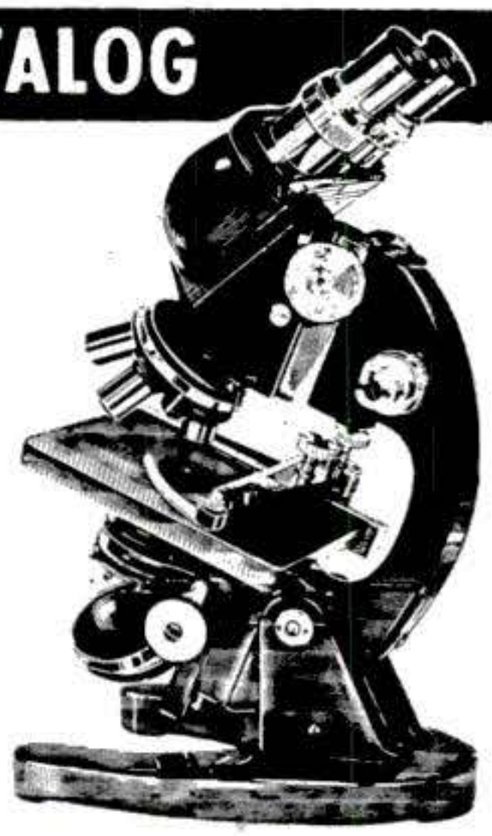

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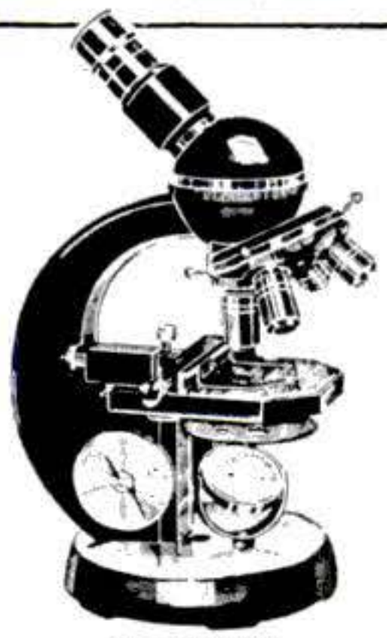

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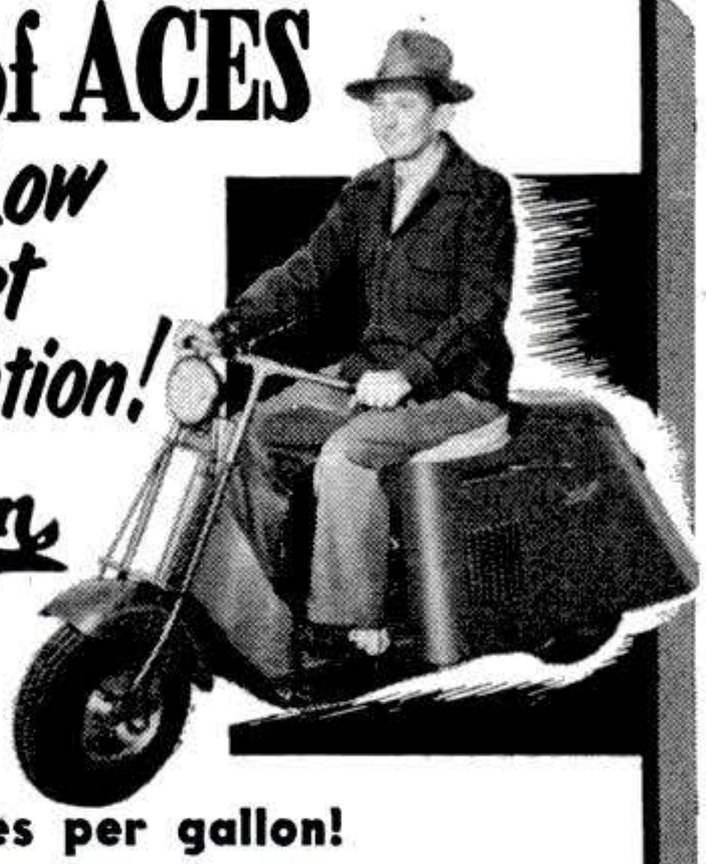

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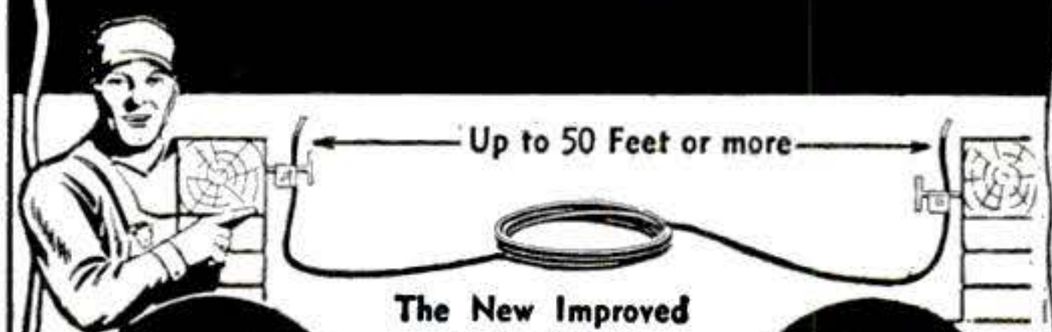

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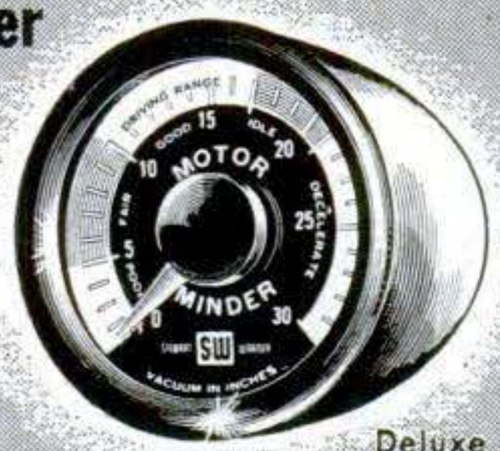

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New Magic Bullet Cures Old Disease

[Continued from page 230]

very slowly, as body fluids break the chemical bond between DBED and penicillin. Potent levels of the antibiotic are maintained in the blood for a month or more.

Drs. Clarence A. Smith and James K. Shafer, assistant chief and chief respectively of the Public Health Service's vital Division of Venereal Disease, who have been directing pioneer chemical studies expect the new drug to play an important role in curbing syphilis among the 2,100,000 Americans who require treatment.

All cases reported on so far were those of persons suffering from relatively recent infections. Three to six weeks after contact a chancre or raised sore appears, the telltale sign of primary syphilis. Then there's a "silent" period of up to a year before secondary syphilis flares up, the main symptom usually being a widespread non-itching rash. These are the early stages of the disease. Results aren't yet in for advanced syphilis, requiring much longer treatment—and study.

Doctor Sees Sharp Cut in Disease

Last year alone about 169,000 early cases were reported. It's estimated that about 20,000 of the group would have developed various forms of advanced syphilis—such as blindness, heart disease, and insanity—if they had not been discovered and treated.

Bicillin will help reduce the syphilis toll even more sharply. Dr. Shafer believes wider use of the substance is definitely on the way. He closed a recent interview with a hopeful look to the future: "If future tests confirm present results—and I know of no reason they shouldn't—it looks like the end of our search for a one-injection treatment for early syphilis." END

Convenient

THE most popular labor-saving device for women is still a husband with money.—*The Columbian Crew.*

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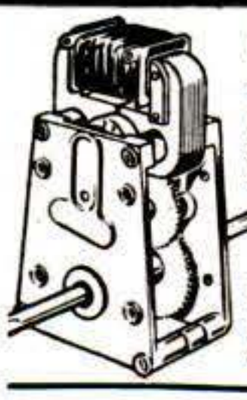

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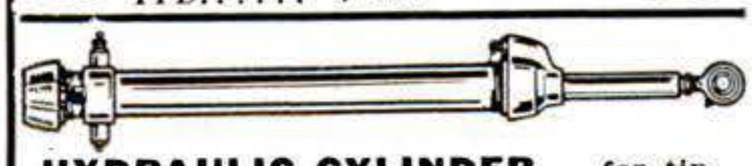

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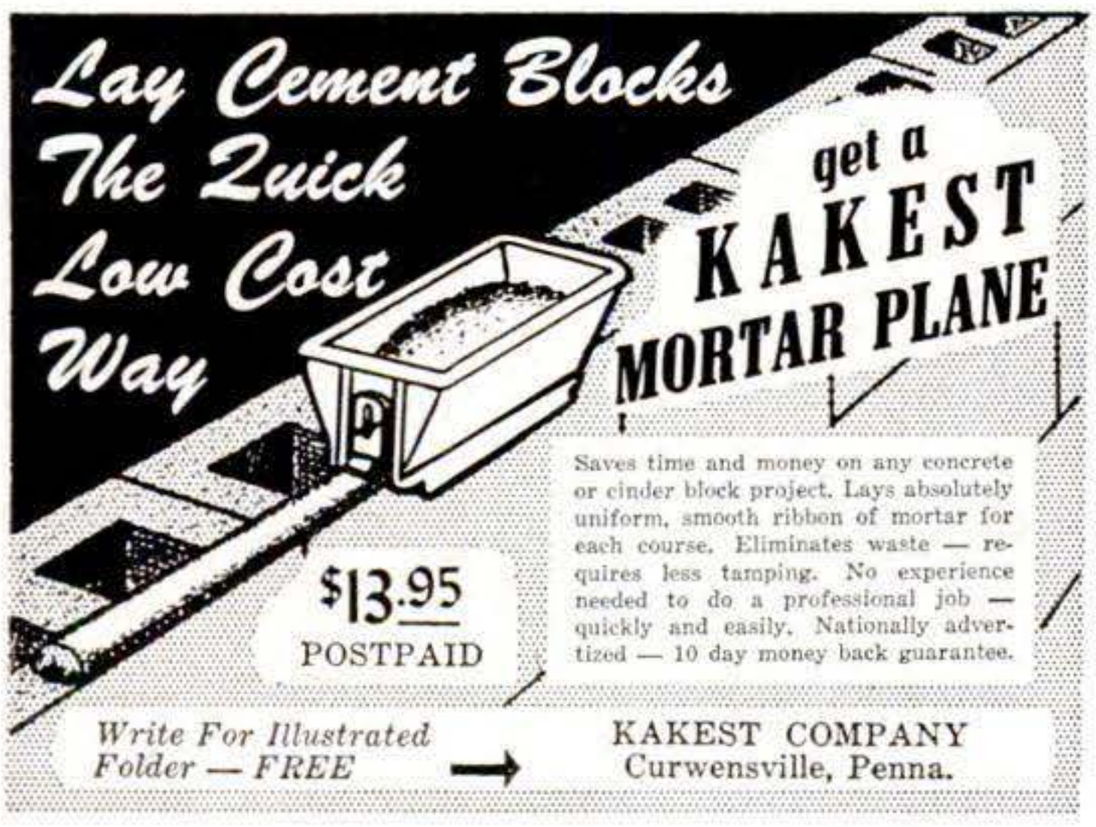

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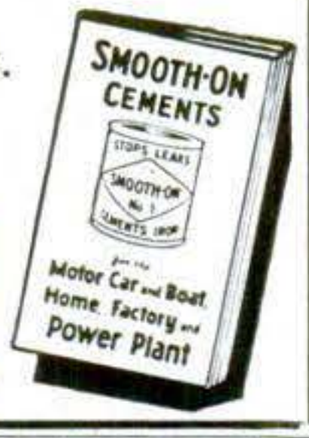

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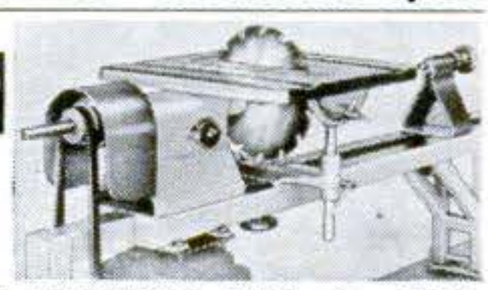

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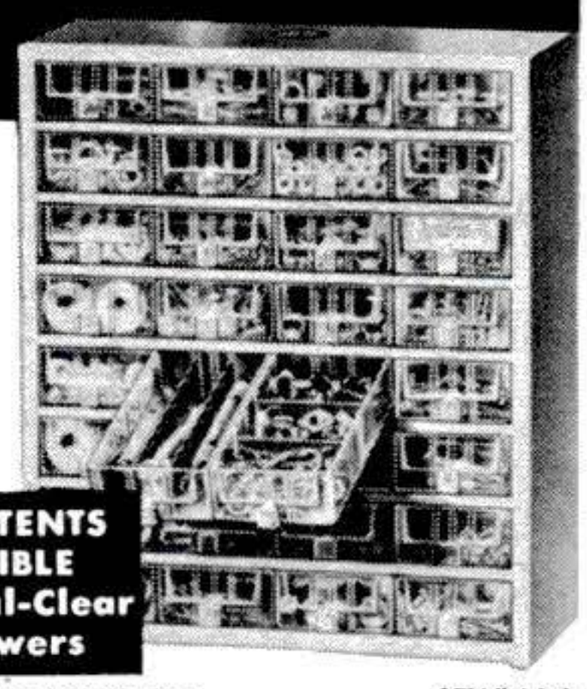

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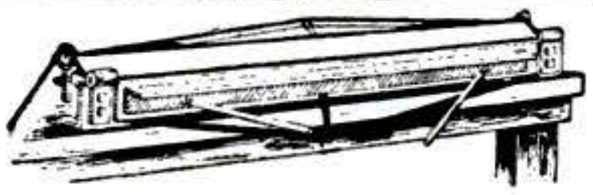

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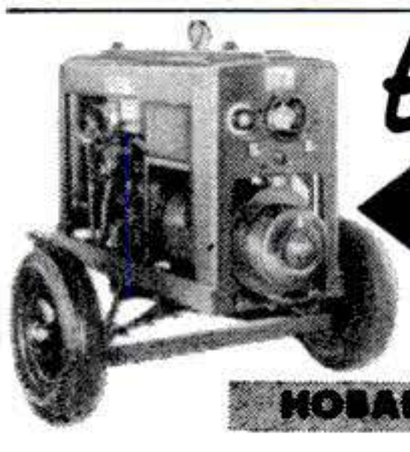

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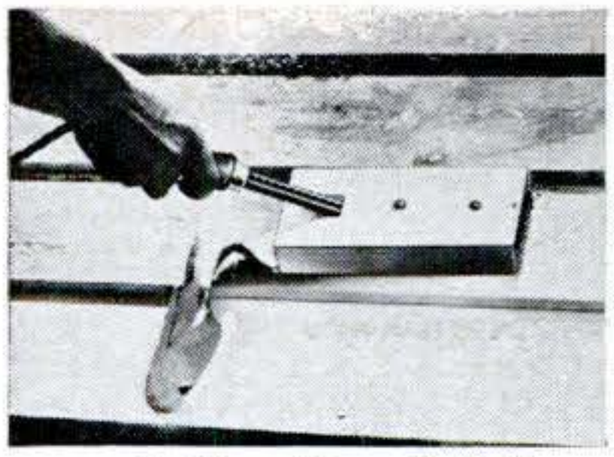

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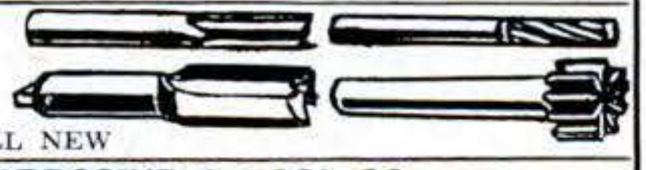

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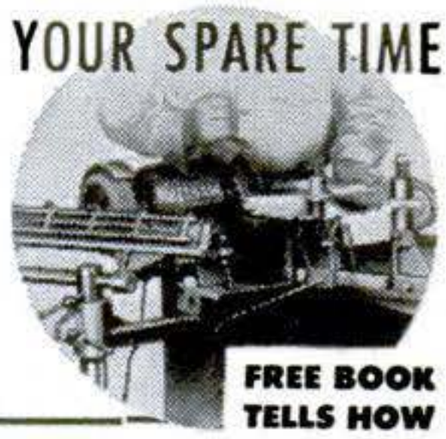

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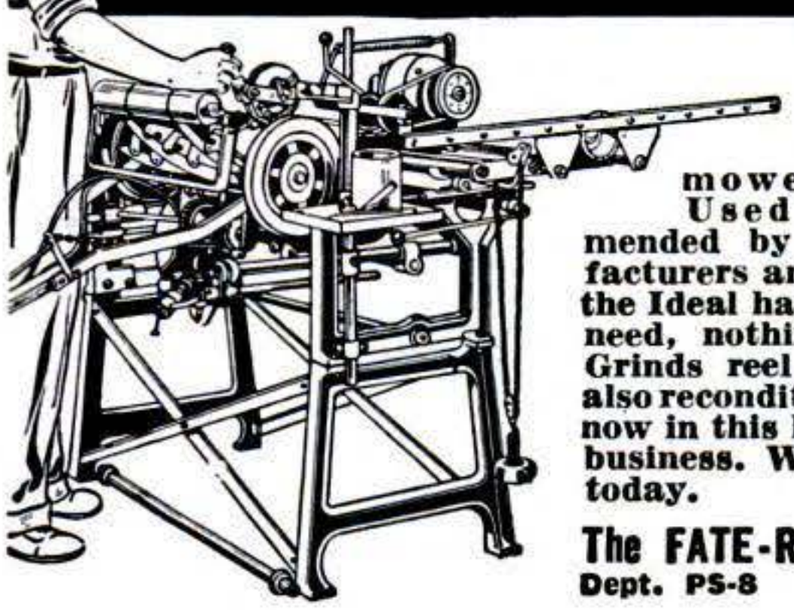

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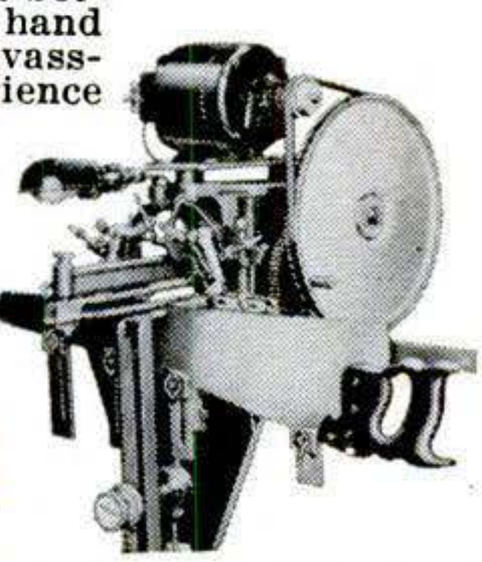

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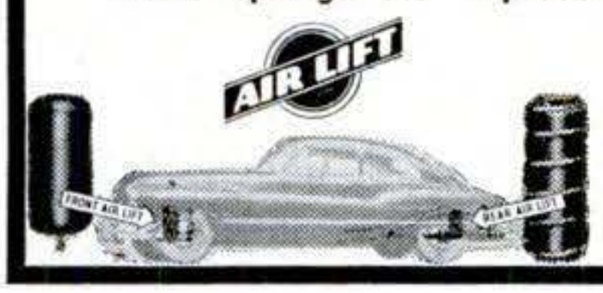

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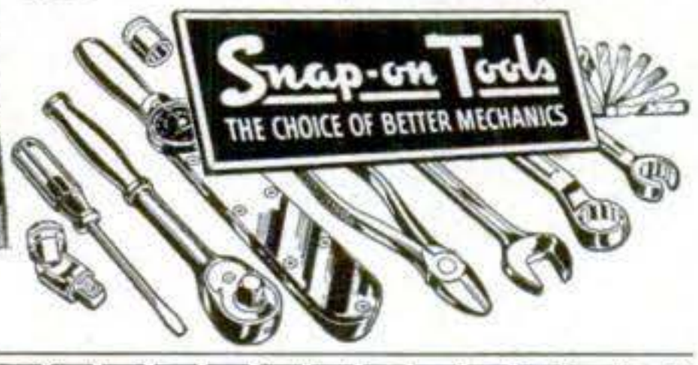

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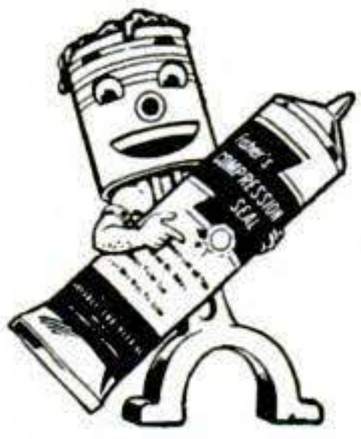

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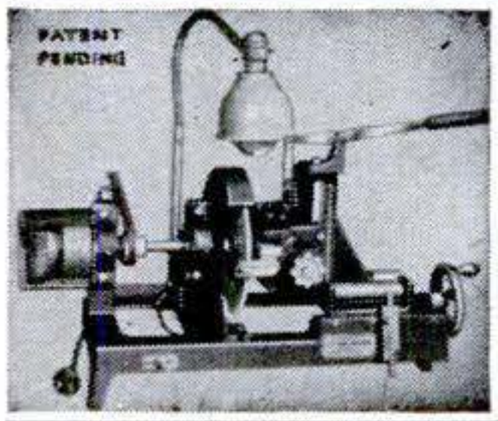

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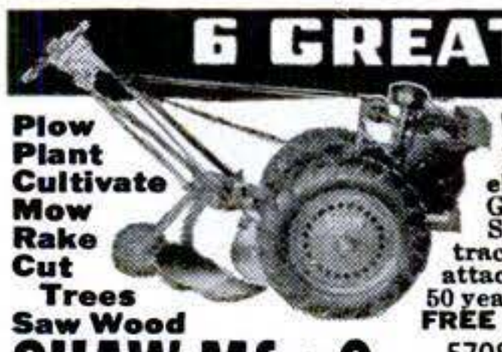

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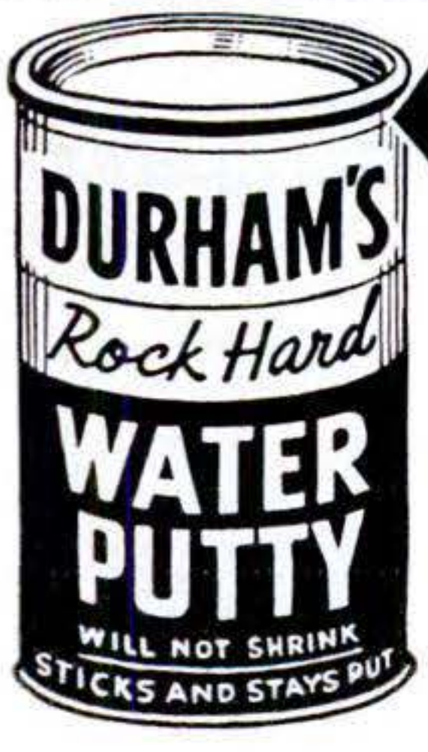

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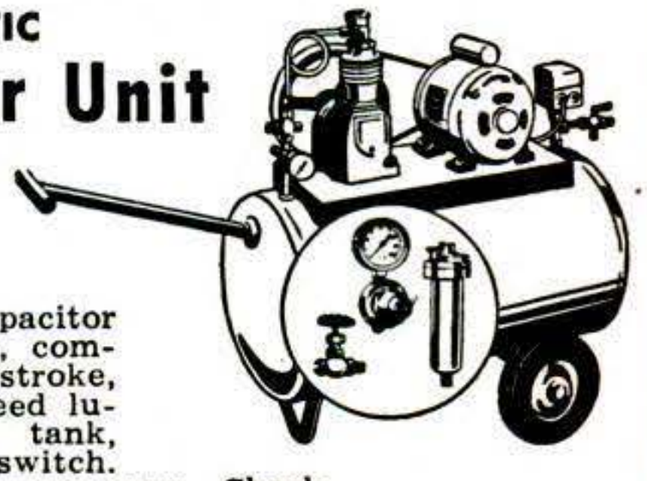

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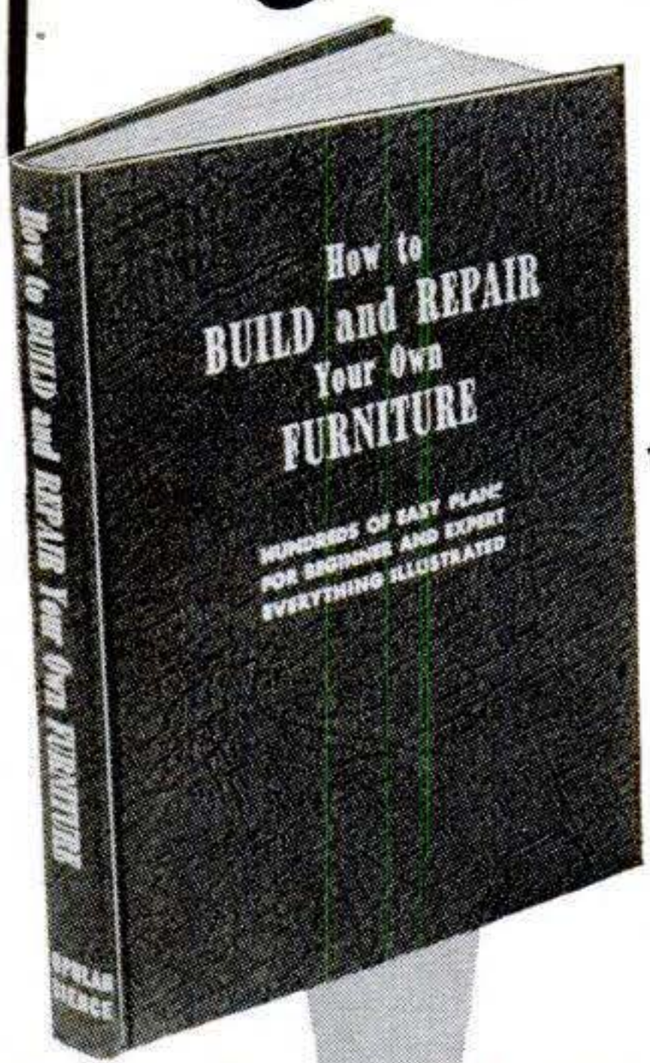

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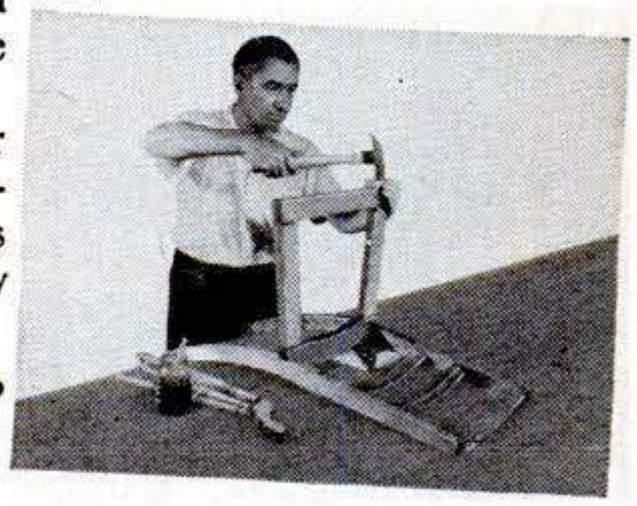

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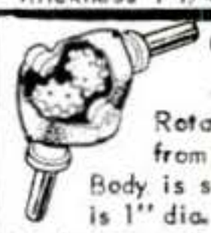

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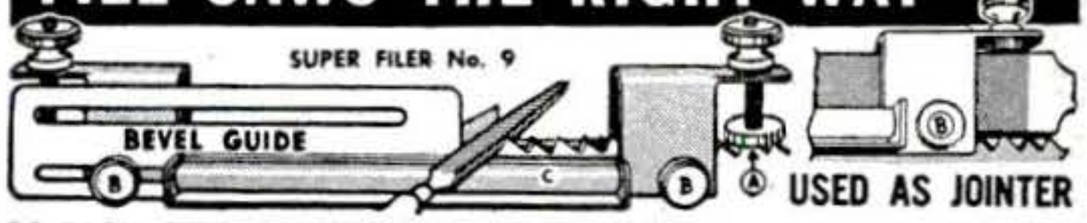

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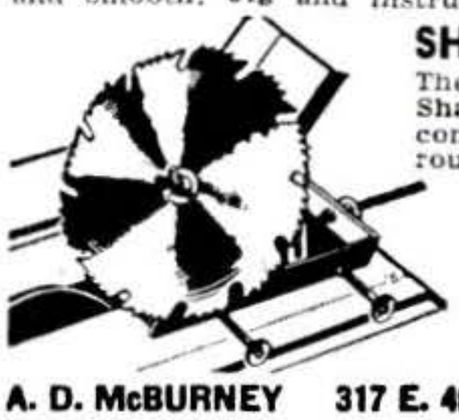

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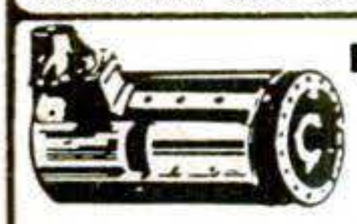

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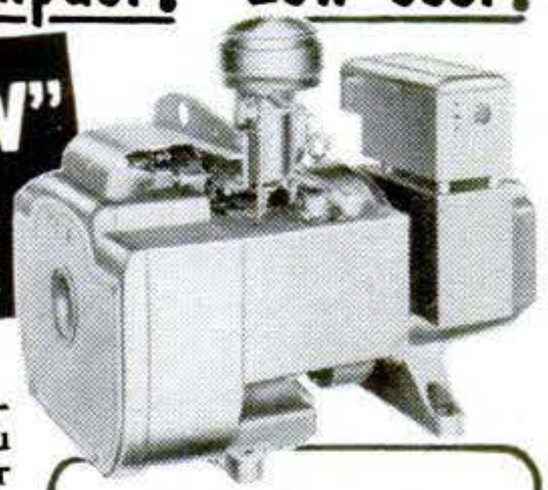

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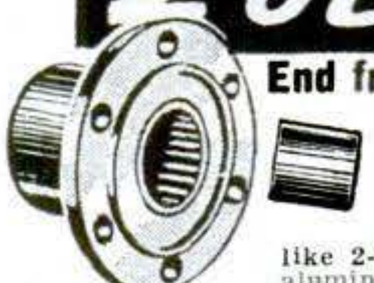

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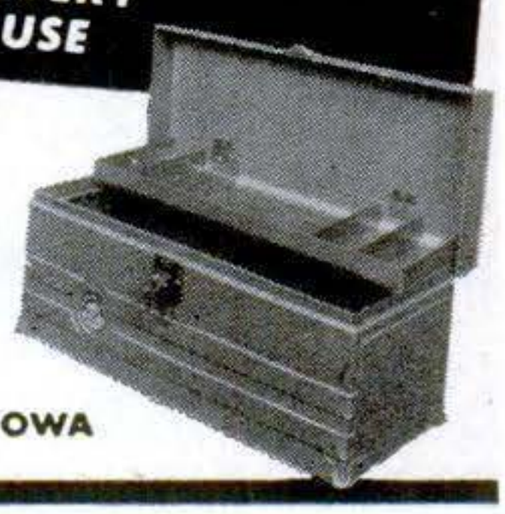

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EDITORS' IMPARTIAL TESTS PROVE:

New Self-Charging Battery Outlasts, Outperforms Others 221%

A few months ago, we started producing a new battery which we frankly believe to be many years ahead of its time. When we announced that this new battery developed 15 amperes more power than other batteries and would automatically bounce back to life again and again after being deliberately and completely discharged, technical editors of leading magazines raised their eyebrows.

When we added that we had named it the *Life*time Battery because of its *life* (meaning exceptional power) and the *time* it would last (3 to 4 times as long as ordinary batteries), and that we guaranteed it for *six years*, these editors were understandably doubtful, to put it mildly. One publisher, in fact, refused to accept advertising for this battery until what he then considered to be our extreme claims were carefully tested.

One of the editors said: "Let us test this battery, any way we see fit. If it does what you claim, it's news our readers will be interested in. If it's no good, our readers will be interested in that, too, and that's the way we'll write the story." We said "go ahead" and they took a standard *Life*time Battery off the production line and went to work.

You may have read the result of the first test in a famous automotive magazine (name on request). Using two well-known batteries (possibly the best-known high-quality batteries in the world) for comparison, they first ran the *Life*time Battery down completely and let it re-charge itself automatically. They repeated this test 43 times the first day, then compared its strength with the other two batteries. Results: the *Life*time Battery was 204% *stronger* than the *strongest* of the other two batteries. They discharged the *Life*time Battery another 20 times, allowing it to re-charge itself automatically each time, and compared all batteries again: the *Life*time Battery was now 213% stronger than one battery, 221% stronger than the other! Next, they put a punishing 300-amp load on the *Life*time Battery; it survived that in good shape. So they repeated the self-recharging test again and finally concluded: "... unprecedented life expectancy ... remarkable recuperative characteristics ... outperformed the others in every respect and by a comfortable margin ... an outstanding value."

The editor of another magazine (name on request) heard about the tests and asked to "give the thing a *real* test, one that would burn up the average battery." We gave him the *same battery* and challenged him to "finish it off." He installed it in his own car and drove the car on the *battery alone*, shifting gears as he would normally, until his "fingers were sore from holding the starter key ... I hate to admit it, but I was outlasted by a battery."

Still another editor wrote: "... definite battery improvement ... greater recuperative power, greater initial output ... obviously high quality."

During independent tests in Alaska and the U.S., the Lifetime Battery was intentionally discharged under sub-freezing conditions, recharged itself automatically & started car at once!

Engineered for Cold Climates

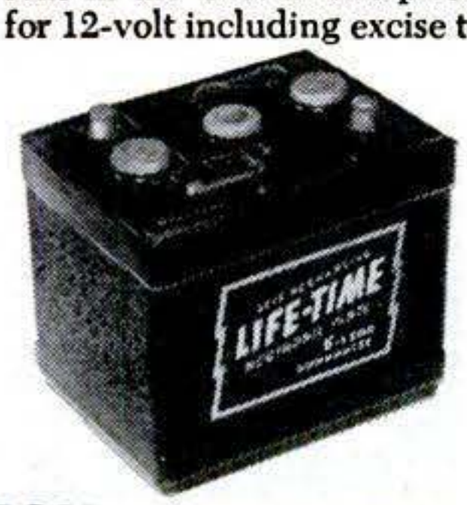
Soon after the *Life*time Battery went into production, we selected a few dealers in northern U.S. and Alaska, shipped them a few batteries and waited to see how the dealers and the public would react. Our Alaska dealer told us that before presenting it to his customers, he was going to give the battery an Arctic test: discharge it completely then freeze it at 30 below zero for 72 hours. Result: the battery had recharged itself and immediately started the car. Immediately we received a telegraphed order from Alaska for $6,043 worth of *Life*time Batteries!

6-Year Guarantee Saves You Up to $107

The average deluxe battery lasts 1.4 years at a typical cost of $25.00, or $107.00 for a 6-year period. This arithmetic is making sense to people who are tired of throwing money away on batteries that just won't hold up. We believe it will make sense to you, too —particularly since the *Life*time Battery you buy now can easily be transferred to your new car whenever you trade in.

12-volt and 6-volt Available

Here's more arithmetic that makes sense: the *Life*time Battery sells in the U.S. at one price for all cars· $29 95 for 6-volt, $34.95 for 12-volt including excise tax.



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Dealerships are now being awarded to take care of demand generated by $1,000,000 advertising campaign plus articles in national magazines. Write today for full information, including reprints of editors' tests and case histories from present dealers.

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Please ship *Life*time Battery at once:
☐ 6-volt ($29.95 including tax)
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One Man Can Operate a Complete TV Station

THE man in the picture above is running a TV station all by himself. At his fingertips on the switchboard are controls for the transmitter, slide and film projectors, audio and transmission facilities—and the big programs that come in from New York and Hollywood. The station is made in a package by GE, which says it costs only one-quarter as much as today's average station, but can blanket a metropolitan area if given the power. GE engineers believe it will hasten the day when the 1,100 small cities recently allotted TV channels will actually get stations.

Smallest TV Studio Camera Costs One-Fourth as Much to Run

MOUNTING TV production costs will be whittled down a bit by the new studio camera being demonstrated by the Kinescope cutie in photo at left. Although it is 33 percent smaller than standard models, it is equally versatile, transmits a better picture, and costs only one-fourth as much to operate.

To let the cameraman concentrate on the artistic side of his job, all gadgets except the lens focusing and positioning controls have been removed from the camera and placed on a monitoring desk. Claude Neon, Inc. engineered the new design.

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It's a plow — It's a rotary tiller
It's a power sickle — It's a bulldozer
It's a cultivator — It's a snow-blower

NO PUSHING

Tractor shown with 20" Rotary Mower Attachment (Item 206)

Where else can you get a power tool that does so many jobs? Works for you year 'round. Does terrific job of cutting grass or weeds. Or prepares mellowed, deep seed beds without labor. Built-in power take-off to drive pumps, saw, generators, etc. Safety clutch—can't burn out. More versatile and efficient than tractors costing twice as much. Converts in minutes to Tiller, Power Sickle, etc. Basic self-propelled 2 hp. tractor. Briggs or Clinton famous engine.. **$119.50**

Rotary Lawn Mower.....$42.50
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Furrowing Tool $8.75 — Rotary Tiller .$42.50
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No other coverall can match the trim tailored effect, the silky sheen or the long wearing quality of this newly developed coverall. Foolproof doubled zippered—off and on in a flash. Beautifully made of extra strong, lightweight Forest Green Nylon—provides cool comfort in hot weather and extra warmth in raw winds over other clothing. 8 zippered pockets—a place for everything. Folds to compact size for carrying anywhere. Unlimited uses for gardeners, pilots, mechanics, servicemen, engineers motorcyclists, farmers, etc. Small, med., large. (Item 43) Reg. $30. Special..... **$12.95**

44 Pc. SOCKET SET

(Item 59b) Highest qual., unconditionally guar. Non-breakable sockets made by Husky. Beautifully matched chrome alloy, absolutely the best. Complete range of 21 sockets from 1/4" thru 7/16" in 1/4" drive and 7/16" thru 1-1/16" in 1/2" drive; 2 extensions, reversible 1/2" ratchet, "L" handle, slide head, all angle coupling, 1/2" speeder handle and a BIG doghouse tool box with ample room for other tools plus 5 pc. hi-chrome alloy combination wrench set and 7 pc. offset wrench set. Easily worth $49.50.. **$19.95**

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(Item 205) Contains a complete set of sockets in 1/2" drive, 3/8" drive and 1/4" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. Beautiful matched chromed thin wall alloy sockets in a sturdy handsome steel tool box. Wt. 17 lbs. List Price $62.90. Factory Special **$26.95**

MASTER AIR COMPRESSOR

Tank Tested up to 500 lbs. per sq. in.

(Item 209) High pressure type for large volume of air for heavy duty service. For paint spraying, inflating truck and auto tires, greasing and the hundreds of other jobs done by compressed air. Piston type. 2" bore compressor with built-in air filter. Master built with hi-strength alloys and precision bearings. Stainless steel tank, 12"x24", 2100 cu. in. cap. Safe up to 500 lb. Equipped with automatic switch that starts and stops motor to maintain desired pressure (up to 150 lb.) and check valve, safety valve, gauge, shut-off valve, 20 ft. air hose and tire chuck. Beautifully balanced on ball bearing wheels and rubber tires. Low factory prices. With 1/3 hp., 110 v. A.C. motor. (Reg. $175.00) (Item 209)..... **$98.50**
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(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM); 8" Fan, wt. 5 lbs. **$6.85**; 9" Fan, wt. 6 lbs. **$7.85**; 10" Fan, wt. 7 lbs. **$8.85**; 12" Fan, wt. 8 lbs. **$9.85. HEAVY DUTY FAN.** Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E).....$11.95
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Our Commando Motor Bike is trouble-free—carries amazing 5 yr. guarantee. Goes up to 150 miles per gal. on all roads. Speed to 40 mph. No oil or gas fumes. Easy automatic pedal or pull starting. Has new principle of automatic transmission. No belts or chains—power transmitted directly to rear wheel. Accelerates quickly. Complete motor and kit ready to attach to your bike in one hour. Get FREE folder. Factory Price **$125.00**
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Heavy duty, made of Buna insulated #14, 2 conductor stranded wire encased in a treated braid jacket moderately flexible and ideal where frequent coiling is not required. Resists oil, grease or water. Use indoors or out. Complete with heavy rubber plug and outlet. (Item 16) 40 ft. 2 1/2 lbs..... **$1.99**
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100 ft. length (1 piece)...(Item 16p) **$4.85**

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Use as portable or shop welder. Up to 300 amps. Senior model. Made for years of trouble-free, continuous service. Will handle light or heavy jobs. Easily welds up to 3/4" plate using 1/4" rods. Built-in air cooling system. Arc is easy to strike and hold, because of specially designed arc stabilizer. Hi-lo switch and dial control gives wide range of welding heats. Run welder at 2600 rpm. with tractor, jeep or 15 hp. gas engine, or 7 hp. elec. motor. Complete with instructions, guar. and triple V belt or flat pulley. You can pay more, but you can't buy a better welder. Wt. 110 lbs. $400 value at **$99.75**
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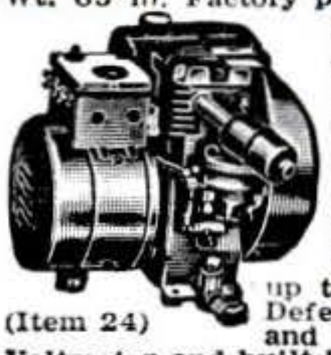
Write for prices on A.C. Arc Welders

PORTABLE LIGHT PLANTS

350 Watt Plant (Item 273) 115 v. DC. 1 1/2 hp. Briggs Engine. Perfect for lights, radios and small power tools, etc. Wt. 65 lb. Factory price..... **$99.75**

PUSH BUTTON START



(Item 24)

AC Plant 600-700 Watts —115 v.-60 cyc. Powered by a rugged 2 hp. easy-starting Briggs gas engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 w. Ideal for Civil Defense, Fire Depts., trailers and camps. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. Item 24. Wt. 75 lbs. Be prepared if war or storms knock out power lines. Reg. $275.00 value.. **$143.50**
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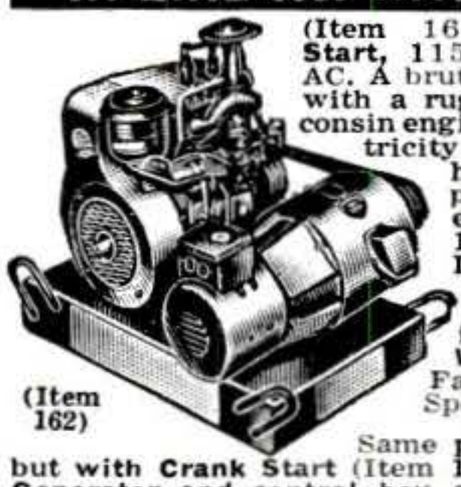
1000-1200 Watt Plant (Item 45) same as Item 24 but with larger generator and engine—50% greater output.. **$199.50**
1500-1700 Watt Plant (Item 20)—Similar to Item 24, but has three times more capacity. Wt. 173 lb. Factory price **$279.50**

MASTER-LITE 2500 Watt PLANT

(Item 21)

110/120 v. 60 cyc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be started by rope or built-in 12 v. electric push button starter. Built-in winding to charge battery. Powered by a big 5.10 Briggs engine, complete with all accessories. Includes control box, voltmeter and handy plug-in power receptacle. Ideal for permanent or stand-by service. Wt. 225 lb. Regular price $645.00. Factory price.. **$329.50**
3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. $760. Factory Price.....$379.50
GIANT 2000-2500 Watt Plant—110/120 v. AC, belt driven so that engine may easily be utilized for other purposes. Powered by a rope start. 6 HP engine. Wt. 230 lb. Regular list price $585.00. Factory price (Item 31)..... **$299.50**
Generator only and control box (Item 31a) $169.50
3000-3500 Watt Plant (Item 198) 110-220 v. 60 cyc. AC. Belt driven with Wis. engine. Push button start. Wt. 370 lb. Heavy duty $399.50
Generator only for belt drive. Wt. 115 lb. (Item 198a).....$239.50

HI-LINE 6000 WATT PLANT



(Item 162)

(Item 162) **Push Button Start,** 115-230 v. 60 cycle AC. A brute of a power plant with a rugged 13 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995.00. With self starter. Factory Spec.... **$645.00**
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We make fully automatic controls to operate any of above light plants. Write for details.

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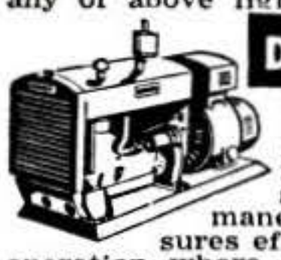

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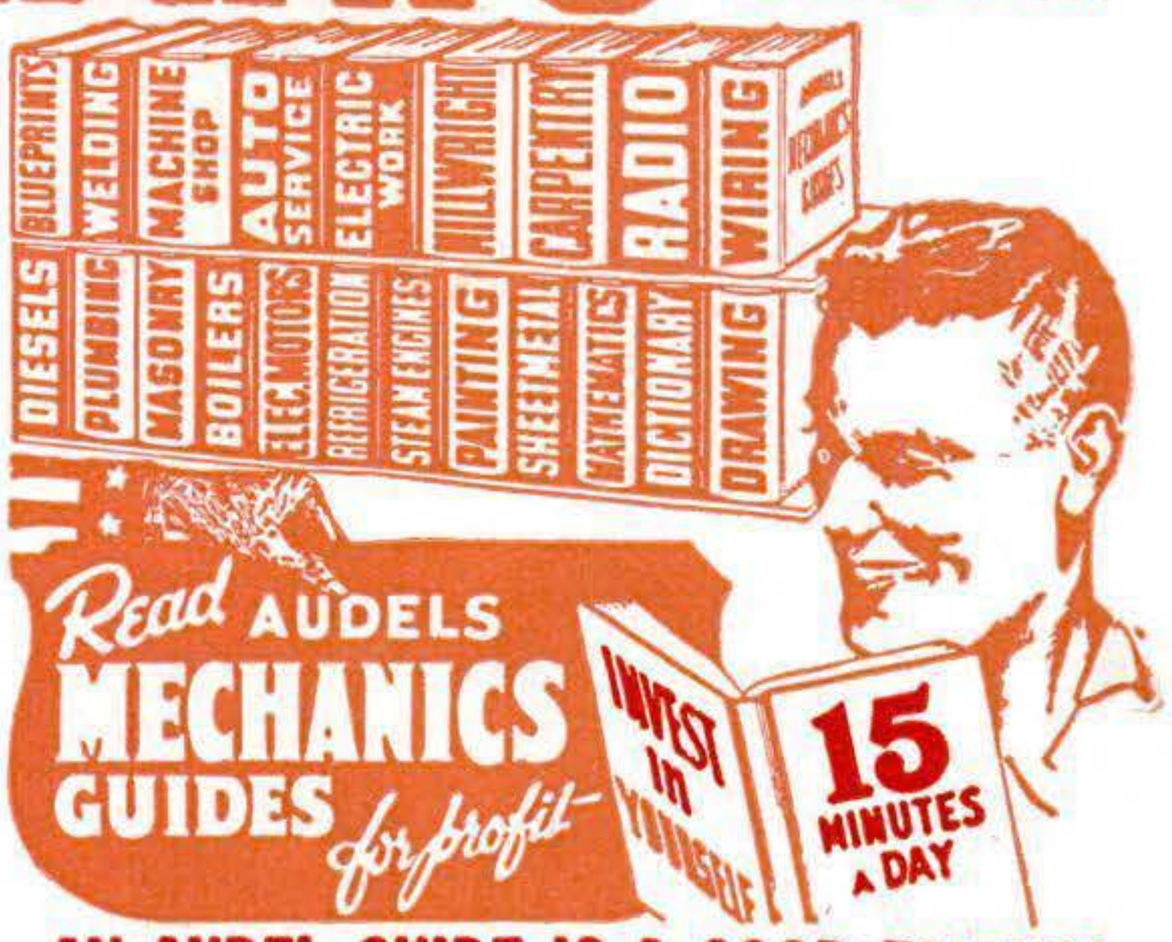

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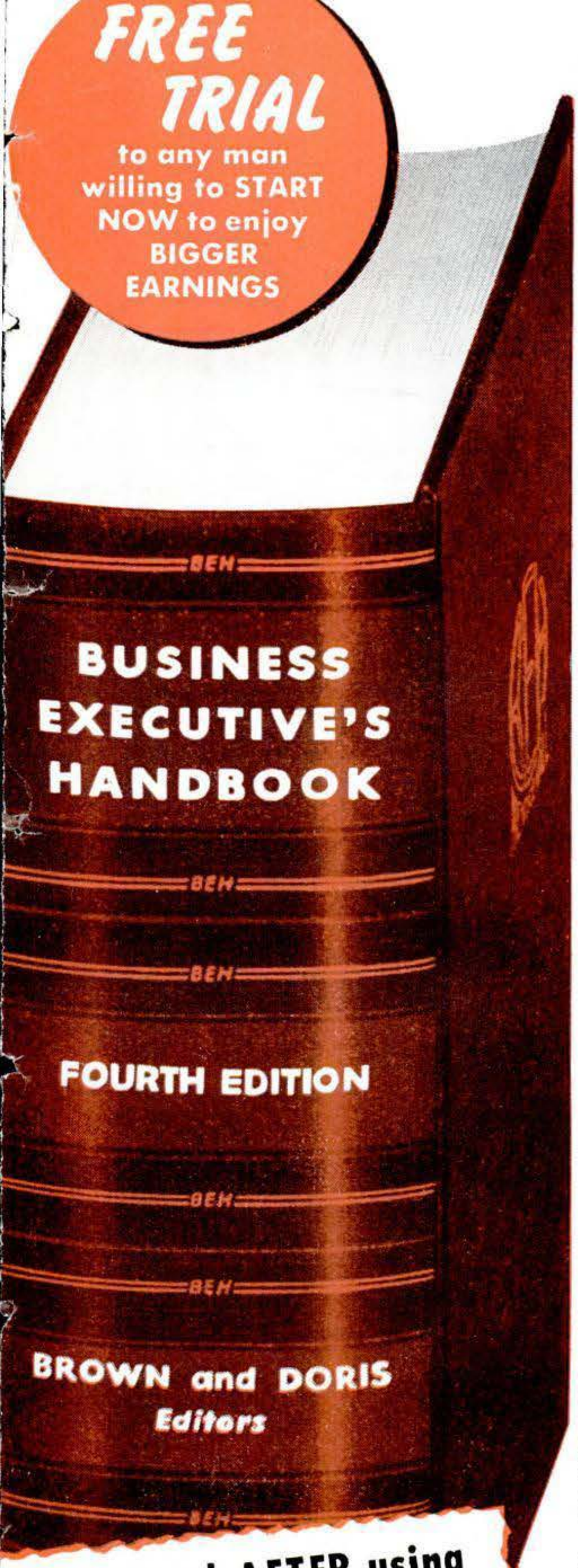

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ORGANIZING AND MANAGING YOUR O BUSINESS: Choosing a form of organization f business; power to do business in any state; ch ing a name under which to do business. Wha partnership agreement should contain; divisio profits and losses among partners; liability o secret partner; power of a partner to bor money, collect debts, employ assistants, purch and sell property; liability of an incoming partr changing to a corporation; duties, powers and bilities of corporate officers and directors.

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